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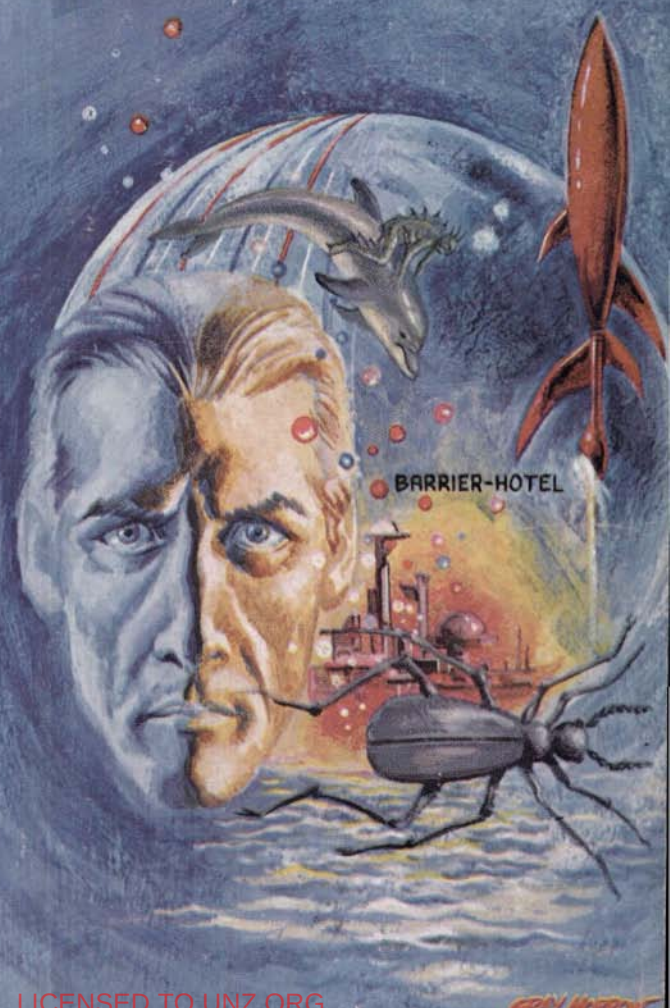

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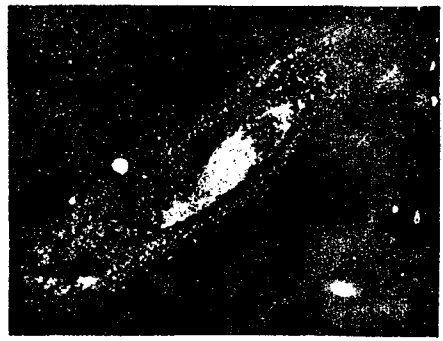

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Old Home Month

A few weeks ago (as this is written; but by the time you see it it's going to be more like a few months), the Eastern Science Fiction Association devoted its annual meeting to honoring *Galaxy*. There were speeches by the likes of Harry Harrison, Lester del Rey, H. L. Gold, Jack Gaughan and any number of others; there was a handsome little placque commemorating the event, which we now have on the wall of our reception room; and we thank them.

And now, if we can say this without sounding too vain, it's our turn. As you will know if you've looked at the forecast for the next issue, we propose to put out a special number for the next issue of *Galaxy* to commemorate its fifteenth anniversary; and this seems as good a time as any to put on record a few things we've held back from saying for a while. (This time the "we" is the editorial plural, by which is meant the present incumbent of the editorial hot-seat, namely Frederik Pohl.)

Horace Gold was the first and longest-lasting editor of *Galaxy,* and he gave it a shape and policy which made a startling impact on the world of science fiction fifteen years ago. It is difficult to exaggerate that impact. One measure of it is that for most of a decade the majority of the other science-fiction magazines imitated Gold's magazine as closely as they could in one way or another. Another is that of the writers who have begun their major careers in science fiction since 1950, nearly every one of them was primarily a *Galaxy* writer. Horace Gold's notion of a proper

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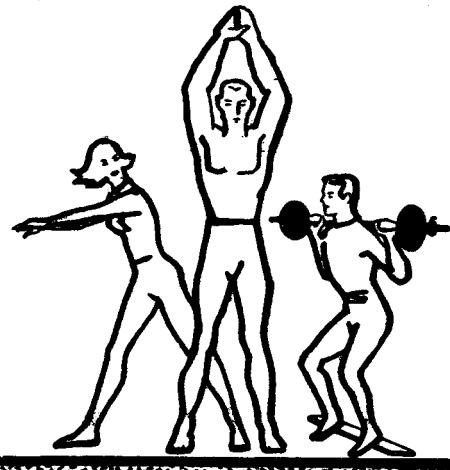

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science-fiction story was, and is, a story which is witty, bright and razor-edged. In order to get what he wanted, Horace Gold spared neither the writers nor himself. He had a reputation among some writers as a sort of slave-driver; but as one of the most frequently flogged of the slaves, the present editor can testify that, more often than not, the results were worth it. All that was gold, Gold saw glittering; and painfully and persistently he set about compelling writers to pan away the dross.

That was the *Galaxy* that was; now let's talk about the present publication of the same name. When we (the undersigned, that is) took over from Gold nearly five years ago it was with the understanding that we were neither able to continue the precise editorial mix that Gold had pioneered — nobody else could do that — nor, as a matter of fact, did we want to. Times change. What is good in 1950 may not be quite right for 1965. We have never stated in the magazine just what it was that we proposed to do differently, but perhaps by now the record speaks for itself and we need only sum it up:

The *Galaxy* of the '50's was a specialist magazine. What it did it did brilliantly, but it did not cover the full spectrum of science fiction. We have tried as best we could to retain some of the best of the 1950-odd *Galaxy* — a story like Robert Sheckley's *Mindswap,* which we published last month, would have been right at home in any of those issues — but also to add some of the other kinds of science fiction that have their own special merits to offer: like the current issue's *Do I Wake or Dream?* by Frank Herbert, which wouldn't have been at home at all. To make this sort of transition is not an easy task (frankly, we were surprised to find how difficult, chancy and slow it was). But we think we've just about managed it; and we are gratified by the letters which have come to show that a good many readers are beginning to think so too.

Next issue, however, is the closest we can come to reproducing in 1965 the kinds of science fiction that characterized *Galaxy* in the 1950's; we've induced a majority of the top *Galaxy* writers of all time to contribute, as many as we can fit into a single issue (you'll find some of the names in the forecast). We mean it to express our own way of honoring H.L. Gold.

And we think you'll like it.

Besides the writers listed in the forecast (and a couple of others not named, if we can fit them in), we will have our regu-

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lars, of course. Algis Budrys's book review section will be taken up by an extremely enjoyable essay (we've just finished reading it) about science fiction in 1950 and where it has led us all; Willy Ley too sets out to reminisce, and does so in pleasant and informative style. But then you know that; his column always is.

Incidentally, we've just received a copy of a new book by Willy which we think you'll like. It's called *Ranger to the Moon* (Signet), and what it's about is clear from the title. Discursive and fact-packed, Willy Ley always adds more to a subject than the bare bones would allow you to expect, however, and in *Ranger to the Moon* he tells about not only the photograph-taking shot that succeeded, but about the predecessors that failed — and why; about the Moon itself, about its explorers that are yet to come, and its explorers of another kind who made their discoveries through the eye of a telescope, at a reach of a quarter of a million miles.

Budrys has been busy, too. For the past three years the man has taken himself out of circulation in order to be an editor, most recently on the *Playboy* staff; but he has put all that behind him and returned to free-lancing. He has three new novels in the works, and we expect we'll be bringing the one of them with which is science fiction to you pretty soon; meanwhile some of the finest of his earlier books are coming out in new editions — *Rogue Moon* and *Who?,* for two — and if you haven't read them, we suggest you do.

We take it, by the way, that you enjoy his book review column as much as we do. The letters we get are what make us think so, of course. But this is a good time, perhaps, to say again what we have said before: *Galaxy* doesn't have a letter column, but all the same we welcome your letters. Omniscient we are not.

We think that we're doing what you want us to with the magazine, but we're always grateful to be told what *you* think. So if the impulse comes to you to drop us a line of comment, don't put it behind you because you think we aren't interested. We are! Vitally! And the only check we have on how well we're succeeding, part from the conclusive but unanalytical reports of sales, is your letters . . .

—FREDERIK POHL

★ ★ ★ ★ ★

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DO I WAKE OR

by FRANK HERBERT

They were terribly alone—on a voyage from the Earth they had never known to the star they would never live to reach!

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DREAM?

Illustrated by GIUNTA

I

"He's dead," Bickel said.

He held up the severed end of a feeder tube, stared at the panel from which he had cut it. His heart was beating too fast and he could feel his hands trembling.

Fluorescent red letters eight centimeters high spelled out a warning on the panel in front of him. The warning seemed a mockery after what he had just done.

ORGANIC MENTAL CORE — TO BE REMOVED ONLY BY LIFE SYSTEMS ENGINEER.

Bickel felt an extra sense of

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quiet in the ship now. Something (not *someone*, he thought) was gone. It was as though the molecular stillness of outer space had invaded the *Earthling*'s concentric hulls and spread through to the heart of this egg-shaped chunk of metal hurtling toward Tau Ceti.

His two companions were wrapped in this silence, Bickel saw. They were afraid to break the quiet moment of shame and anger . . . and relief.

"What else could he do?" Bickel demanded. He held up the severed tube, glared at it.

Raja Flattery, their psychiatrist-chaplain, cleared his throat, said: "Easy, John. We share the blame equally."

Bickel turned his glare on Flattery, noted the man's quizzical expression, calculated and penetrating, the narrow, haughty face that somehow focused a sense of terrible superiority within remote brown eyes and upraked black eyebrows.

"You know what you can do with your blame!" Bickel growled, but Flattery's words destroyed his anger, made him feel defeated.

Bickel swung his attention to Timberlake — Gerrill Timberlake, life systems engineer, the man who should've taken responsibility for this dirty business.

Timberlake, a quick and nervous scarecrow of a man with skin almost the color of his brown hair, stared at the metal deck near his feet, avoiding Bickel's eyes.

Timberlake's weakness — his inability to kill the OMC even when that meant saving the ship with its thousands of helpless lives — had almost killed them all. And all the man could feel now was shame . . . and fear.

There'd been no doubt about what had to be done. The OMC had gone mad, a wild runaway consciousness. It had been a sick ball of gray matter whose muscles turned every servo on the ship into a murder weapon, who stared out at them with madness from every sensor, who raged gibberish at them from every vocoder.

No, there'd been no doubt — not with three of their number murdered. The only wonder was that they'd been allowed to destroy it.

Perhaps it wanted to die, Bickel thought.

And he wondered if that had been the fate of the six other Project ships which had vanished into the nothingness without a trace.

Did their OMCs run wild? Did their umbilicus crews fail when it was kill or be killed?

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A tear began sliding down Timberlake's left cheek.

To Bickel, that was the final blow. Some of his anger returned. He faced Timberlake, said: "What do we do now, *Captain?*"

The title's irony wasn't lost on either of Bickel's companions. Flattery started to reply, thought better of it. If the starship *Earthling* could be said to have a captain (discounting an in-service Organic Mental Core) then unspoken agreement gave that title to an umbilicus crew's life systems engineer. None of them, though, had ever used the word officially.

At last, Timberlake met Bickel's stare, but all he said was: "You know why I couldn't bring myself to do it."

Bickel continued to study Timberlake, measuring the man. What shabby conceit had given them this excuse for a life system engineer? Once the umbilicus crew had numbered six — the three here plus Ship Nurse Maida Blaine, Tool Specialist Oscar Anderson and Biochemist Sam Scheler. Now, Blaine, Anderson and Scheler were dead — Scheler's exploded corpse jamming an access tube on the aft perimeter, Anderson strangled by a rogue sphincter lock and lovely Maida mangled by runaway cargo.

Bickel blamed most of the tragedy on Timberlake. If the damn' fool had only taken the ruthless but obvious step at the first sign of trouble. There'd been plenty of warning — with the first two of the ship's three OMCs going catatonic. The seat of trouble had been obvious. And the symptoms — exactly the same symptoms that had preceded the breakdown of the old Artificial Consciousness project back on earth — insane destruction of people and material. But Tim had refused to see it. Tim had blathered about the sanctity of all life.

Life, hah! Bickel thought. They were all of them — even the colonists down in the hyb tanks — expendable biopsy material, Doppelgangers grown in gnotobiotic sterility in the Moonbase. "Untouched by human hands." That'd been their private joke. They'd known their earth-born teachers only as voices and doll-size images on cathode screens of the base intercom system — and only occasionally through the triple glass at the locks that sealed off the sterile creche. They'd emerged from the axolotl tanks to the padded metal claws of nursemaids that were servo extensors of Moonbase personnel forever barred from intimate contact with those they served.

Timberlake glanced around at

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the familiar room in the ship's core — Command Central — a space twenty-seven meters long and twelve meters on the short axis. Like the ship, Com-central was vaguely egg-shaped. Four cocoon-like action couches with almost identical control boards lay roughly parallel in the curve of the room's wider end. Color-coded pipes and wires, dials and instrument controls, switch banks and warning telltales spread patterned confusion against the gray metal walls. Here was the necessities for monitoring the ship and its autonomous consciousness — an Organic Mental Core.

Organic Mental Core, Timberlake thought, and he felt the full return of his feelings of guilt and grief. *Not human brain, oh, no. An Organic Mental Core. Better yet, an OMC. The euphamism makes it easier to forget that the core once was a human brain in an infant monster — doomed to die. We take only terminal cases since that makes the morality of the act less questionable.*

And we killed it.

"I'll tell you what I'm going to do," Bickel said. He looked at the Accept-and-Translate board auxiliary to the transmitter on his personal control console. "I'm going to report back to Moonbase what's happened." He turned away from the raped panel, dropped the severed feeder tube to the deck without looking at it.

The tube drifted downward slowly in the ship's quarter gravity.

"We've no code for this . . . this kind of emergency," Timberlake said. He moved to confront Bickel, stared angrily at the man's square face, disliking every feature of it from the close-cropped blond hair to the wide mouth and pugnacious jaw.

"I know," Bickel said, stepped around Timberlake. "I'm sending it clear speech."

"You can't do that!" Timberlake protested, turning to glare at Bickel's back.

"Every second's delay adds to the timelag," Bickel said. "As it is, it has to go more than a fourth of the way across the solar system." He dropped into his couch, set the cocoon to half enclose him, swung the transmitter into position.

"You'll be blatting it to everyone on earth, including you-know-who!" Timberlake said.

Because he half agreed with Timberlake and wanted to gain time, Flattery moved to a position looking down on Bickel on the couch, said: "What specifically are you going to tell them?"

"I'm not about to mince

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words," Bickel said. He threw the transmitter warmup switches, began checking the sequence tape. "I'm going to tell 'em we had to unhook the last brain from the ship's controls . . . and kill it in the process."

"They'll tell us to abort," Timberlake said.

The merest hesitation of his hands on the tape-punch keyboard told that Bickel had heard.

"And what'll you say happened to the brains?" Flattery asked.

"They went nuts," Bickel said. "I'm just going to report our casualties."

"That's not precisely what happened," Flattery said.

"We'd better talk this over," Timberlake said, and he felt the beginnings of desperation.

But Bickel threw the master switch. A skin-creeping hum filled Com-central as the laser amplifiers built up to full potential.

I should stop him, Flattery thought as Bickel fed the voco-tape into the transmitter. *But what good would that do? We have to get the message out and clear speech is the only way.*

There came the click-click-click as the message was compressed and multiplied for its laser-jump across the solar system.

With a chopping motion that carried its own subtle betrayal of self doubt, Bickel slapped the orange transmitter key. He sank back as the transmit-command sequence took over. The sound of relays snapping closed dominated the ovoid room.

Do something even if it's wrong, Flattery reminded himself. *The rule books don't work out here. And now it's too late to stop Bickel.*

It came to Flattery then that it had been too late to stop Bickel from the moment their ship left its moon orbit. This direct-authoritarian-violent man (or one of his backups in the hyb tanks) held the key to the *Earthling*'s real purpose. The rest of them were just along for the ride.

"How long d'you suppose it'll take Moonbase to answer?" Bickel asked Timberlake.

Flattery stiffened, studied the back of Bickel's head. The question . . . such a nice balance of cameraderie and apology in the voice . . . Bickel had done that deliberately, Flattery realized. Bickel went deeper than they'd suspected, but perhaps they should've suspected. He was, after all, the *Earthling*'s pivotal figure.

"It'll take 'em a while to digest it," Timberlake said. "I still think we should've waited."

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Wrong tack, Flattery thought. *An overture should be accepted.* He brushed a finger along one of his heavy eyebrows, moved forward with a calculated clumsiness, forcing them to be aware of him.

"Their first question'll be why'd the OMCs fail," Timberlake said.

"There was no medical reason for it," Flattery said. He realized he'd spoken too quickly, sensed his own defensiveness and added: "At least, as far as I could determine."

"It'll turn out to be something new, something nobody anticipated, wait and see," Timberlake said.

Something nobody anticipated? Bickel wondered.

Still, six other ships had vanished into silence out here — six other ships much like their *Earthling.*

Timberlake adjusted a dial on his console to correct a failure of automatic temperature adjustment in quad three ring nine of the ship's second shell. "We should've been buttoned down in our hyb tanks and on our way over the solar hump to Tau Ceti long ago," he muttered.

"Tim, display the timelog," Flattery said.

Timberlake hit the green key in the upper right corner of his board, glanced at the overhead master screen's display from the laser-pulse timelog.

Ten months — plus.

The indefinite answer made it seem the *Earthling*'s computer core shared their doubts.

"How long to Tau Ceti?" Flattery asked.

"At this rate?" Timberlake asked. He risked a long glance away from his board. The stare he aimed at Flattery betrayed the fact he hadn't thought of *that* possibility, making the trip the hard way — long and slow with a crew active all the way.

"Say four hundred years, give or take a few," Bickel said. "It's the first question I fed into the computer after we disabled the drive increment."

He's too crystal sharp, Flattery thought. *He bears watching lest he shatter.* And Flattery chided himself then: *But the job Bickel has to do requires a man who can shatter.*

"First thing we'd better do is bring up one replacement from the hyb tanks," Bickel said.

Flattery glanced to his left where the Com-central's other three action couches lay with their cocoon arms open, empty and waiting.

"Bring up only one replacement, eh?" Flattery asked. "Live in here?"

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"We may need occasional sleep-rest periods in the cubby lockers," Bickel said and he nodded toward the side hatch into their spartan living quarters. "But Com-central's the safest spot on the ship."

"What if Project orders us to abort?" Timberlake asked.

"That won't be their first order," Bickel said. "Seven nations invested one helluva pile of money and effort and dreams in this business. One nation might give up immediately . . . seven nations, no. It could take 'em months to reach *any* kind of agreement."

Too crystal sharp, Flattery thought. And he asked: "Who're you nominating for dehyb?"

"Prudence Weygand, M.D.," Bickel said.

"You think we need another doctor, eh?" Flattery asked.

"I think we need Prudence Weygand, that's all," Bickel said. "She's a doctor, sure, but she can also function as a nurse to replace . . . Maida. She's a woman and we may need female thinking in . . ."

"And if we have to make the trip the hard way," Flattery said. He nodded. Yes, they'd have to breed replacements for the crew. Bickel was thinking ahead, planning.

"You have any objection to Weygand, Tim?" Bickel asked.

"What's my opinion worth?" Timberlake muttered. "You two've already decided it, haven't you?"

Bickel already had turned toward his own action couch. He hesitated at the sound of anger in Timberlake's voice, then went on to the couch, pulled the full vacuum suit from the rack beneath the couch and began suiting up. He spoke without turning: "I'll take over here then while you and Raj bring her out of hyb. You'd both better suit up, too, and stay suited from now on in. Without an OMC at the controls . . . well . . ." He shrugged, finished sealing the suit and stretched out in his action couch. "I'll take the red switch on the count."

Timberlake was caught up then in the change-over. The master board swung across on its travelers, stopped as it made junction with Bickel's console.

Bickel satisfied himself the ship was functioning as well as it could without the homeostatic control of an OMC. He sank back to watch the board as the others left Com-central. The hatch seals hissed and there came the metallic slap of the magnetic locks as the hatch closed and resealed itself.

Now, Bickel felt the ship around him as though he had neural connections to every sen-

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sor revealed on his board. The *Earthling* lay spread out for him — a monstrous juggernaut . . . yet fragile as an egg.

A Tin Egg.

Among themselves, they'd called it the Tin Egg from the moment someone had noted the homonym in the name of the ship's Dutch-Siamese chief designer: Tien Aq.

Something about the Tin Egg was sour—Big Sour. It didn't make sense to Bickel that a man had to sit here in Com-central, the strain of responsibility increasing with each heartbeat, waiting and knowing some mechanism or balancing function of the ship was headed for trouble —yet unable to meet the problem with more than a gross, clumsy makeshift.

With the OMCs, this ship balance had been a finely tuned neuro-servo reflex, almost automatic—as homeostatic in response as a healthy human body.

Bickel added his own question now to the long list that had been posed: *Why were all the eggs put in one basket?*

II

As she awoke, she thought: *We made it! Two hundred years across space and we made it!*

Excitement filled her at the thought of stepping out onto a virgin world with all its strange newness and never-before problems. Six failures were worth it. The seventh try was a charm. We've succeeded. Otherwise . . . otherwise . . .

Her mind bogged down in sluggishness. *Otherwise* was a concept with several pathways out of it.

The tingle-ache of dehyb ran along the muscles of her arms and legs, produced transient knots of pain. She knew as a doctor the reasons for the pain, could rationalize the fact of it: human *hybernation* was a far different process from animal hibernation. Not a drop of water could remain in the body—and you went so close to the borders of death that some contended you were suspended *within* death. The pains of dehyb could be explained easily enough, but no description was adequate. They had to be experienced to be understood.

She tried to sit up.

It was then she saw Timberlake and Flattery looking down at her where she lay on the lab shuttle. Their expressions brought *otherwise* to full focus. For a moment, she looked beyond them to the tubes and stimulant plugs that had been removed from functional contact with her body.

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Flattery restrained her. "Easy now, Dr. Weygand," he said.

Dr. Weygand, she thought. *Not Prudence. Not Prue.*

She began losing that first elation.

Then Flattery began explaining in his soft, soothing voice and she knew her elation had to be put away. The contingency problem had arisen. She had been awakened for that.

"Just tell me how many we lost," she said, and her throat hurt from its months of disuse.

Timberlake told her.

"Three dead?" she said. She didn't ask how they had died. The other problem, the contingency for which she had been prepared took precedence over mere curiosity.

"Bickel requested you be brought out of hyb."

"Does he know why?" she asked, ignoring the strange look Timberlake shifted from her to Flattery.

"He rationalized it," Flattery said, and he wished she'd withheld these questions until they were alone.

"Of course he did," she said. "But has . . ."

"He hasn't posed the problem yet," Flattery said.

"Don't push him," she said, and glanced at Timberlake. "Forget what you just heard here, Timberlake."

Timberlake scowled, suddenly withdrawn and wary.

Flattery bent over her right arm with a slapshot hypo in his hand.

"Must you?" she asked. Then: "Yes, of course."

"There's nothing for you to do right now except recuperate," he said, and pressed the slapshot against her arm.

She felt the mechanism's kick and, presently, the soft spread of narcosis. Flattery and Timberlake became wavering figures haloed in light.

At least Bickel's still alive, she thought. *We won't have to replace him with a backup—take second best.*

And just before sinking into the downy cloud of sleep, she wondered: *How did Maida die? Lovely Maida who . . .*

Timberlake watched the film of withdrawal wash over her light blue eyes. Her breathing took on soft regularity.

As life systems specialist, Timberlake had checked the computer-filed tape flag for every person on the Tin Egg. He recalled that Prudence Weygand was classed superb as a surgeon—"Superior 9 in tool facility." And the scale went only to 10. He reflected on her strange conversation with Flattery and realized the tape hadn't told the

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full story. She obviously had ship functions beyond surgeon-ecologist . . . and at least one of these functions concerned Bickel.

"*Forget what you just heard here, Timberlake.*"

Timberlake could still hear that cold-voiced command and he knew it didn't square with the emotional index on Prudence Weygand's tapes. There she was listed as "Place nine-d green" on the compassionate vector. In the close-quarters living of this umbilicus crew, that emotional index posed problems because of its tightly linked sex drive. With a sense of shock, Timberlake took a closer look at her feed-tube spectrum on the hyb chart, saw that she'd been fed the sex suppressant anti-S drugs even under hyb. She'd been kept ready.

Ready for what? he asked himself.

Flattery closed and locked her litter cocoon, said: "She'll sleep until she's almost back to normal. We'd better check her size now, too, and get her a full-vac suit out of stores. She'll need it when she comes out."

Timberlake nodded, made a last check on the few remaining life-systems linkages into her litter. Flattery was acting very odd. Mysterious.

"You can ignore all that conversation as she woke up," Flattery said. "Common dehyb confusion. You know how it is."

But she was fed anti-S drugs in hybernation, Timberlake thought.

Flattery nodded toward the hatch into Com-central, said: "John's been almost four hours alone on the board. Time he got some relief."

Timberlake finished his inspection of the litter gauges, turned, led the way through the hatch.

Seeing the wary, thoughtful look on Timberlake's face, Flattery thought: *Damn that woman's big mouth. If Tim says the wrong thing to Bickel now it could muddy the whole project.*

Bickel heard Flattery and Timberlake enter Com-central, but was forced to keep his attention on the big board. An odd timed pulse had appeared in the primary loops of the navigational analogue banks of the computer. It appeared and vanished with no apparent cause.

Timberlake came up beside Bickel, studied the gauge which showed the timed pulse in the navigational analogue banks.

"That acts like a Doppler reference pulse from the timelog," he said. "You been checking our position?"

"No," Bickel said, and as he spoke the answer to this variant pulse clicked home in his mind. He *had* set up a telltale

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warning net in the computer to alert him when ship damage reached a critical point. Damage to the navigational system could be most critical—especially internal damage. But unlike destruction of hardware, that internal damage would only betray itself by position errors. His telltale circuitry had alerted one of the ship computer's master programs. A running Doppler reference check was being made on their position.

Bickel shifted to the computer board, ran a series trial on the navigational loops, read the induced resonance off the pulsing gauges. It checked.

He explained what was happening.

"The computer acts . . . almost . . . human," Flattery said.

Bickel and Timberlake exchanged a knowing smile. *Almost human, indeed!* The damn' thing merely was doing what it was designed to do. Bickel had just overlooked the fact that this was in the design.

"We'd better take the computer schematics and design specs and have a real skull session on what the lack of an OMC may be doing to it," Timberlake said.

Bickel nodded.

He was thankful then that Timberlake was, in many respects, as good an electronics man as anyone on the ship—the necessary foundation for his specialty. There was always that *almost* qualification on his abilities, though. Life systems work trapped a man into a "generalist" corner. They knew plenty of biophysics, but they weren't doctors. They were adept in electronics, but fell short of that smooth juggling of variables which marked the true adept.

"You ready for a break, John?" Flattery asked.

"Any time. How's Prue?"

"*Doctor* Weygand is asleep now," Flattery said. "She needs a few more hours recuperation."

Why's he so formal? Bickel wondered. *Raj must know I shared classes with her. She was always Prue then. Why should she suddenly be Doctor Weygand?*

"I'll take the board on the count," Flattery said, and they began the change of watch.

Timberlake, sensing Bickel's questions, realized that Flattery's emphasis on *Doctor* Weygand had not been aimed at the electronics engineer.

Raj was saying something to me, Timberlake thought. He *was telling me that Doctor Weygand may've had medical reasons for her strange behavior. Raj is telling me to keep my mouth shut.* And Timberlake found himself resenting the fact that Flattery

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had found the warning necessary.

Bickel closed off his link to the controls, slipped off his couch and began exercising the stiffness out of his muscles. Remembering the classes he'd shared with Prue Weygand—computer math, servo-sensor repair, ship function—he recalled the woman. She was a disturbing female-plus creature, sensitive and with her feelings all too apparent. Bickel realized then that a photograph of Prue Weygand in repose would show a rather unassuming woman with regular features and a good, but not sensational figure. She was the kind who attracted male stares, though. She radiated some vital, sparking thing—especially when she walked.

Is that why I chose her? Bickel wondered. He broke off his exercises to consider the question. The Prue kind of woman presented a source of trouble in anotherwise all-male crew—unless they all went on anti-S. But they couldn't afford to dull their faculties that way.

Bickel forced this out of his mind by looking around Comcentral, focusing his attention on the ship—Tien Aq's "Tin Egg." The ship cum computer cum hybernating colonists—here was one set of resources that Bickel felt they could fit into a logical pigeonhole, assess and weigh and use as they needed.

He sensed the ship stretching out from him in its sixteen concentric shells: a great ovoid bulk almost a mile across its long axis. Beyond the water barrier and baffles that shielded the core lay miles of corridors and tubeways, self-sealing compartments. Through it all stretched the organized clutter of material expected to make life possible for humans in an alien environment.

In the hyb tanks they had two thousand adult humans, a thousand embryos and more than six thousand animal embryos—"a full ecological spectrum."

Bickel turned, looked at his own computer board. Logic told him their main chance of survival lay in the computer. His plan involved dangerous risk to the computer, but the risk was necessary. The others might fight him, but they have to come around.

"How long until Prue will be with us?" he asked.

"About three hours," Timberlake said.

"I want her opinion on the post mortem," Bickel said. "I'm not satisfied with what we found in the first two brains."

Timberlake shut down his

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couch massage, directed a probing stare at Bickel.

"I went through the entire console when Brain One failed," he said. "Check it yourself."

"I did," Bickel said. "A couple of things bothered me. Brain One preferred to be called Myrtle. Why? I find nothing in the memory core to explain that—except that Brain One was removed from a genetic monster that probably was female."

"Myrtle's personal life system tested within .0002 of homeostatic center on the Anders Base," Timberlake said. "Her reserve life systems were in stasis and precisely on the base."

"Don't let that identity preference seduce you," Flattery said. "It was for our benefit—so we could anthropomorphize the ship-OMC."

"Yeah," Bickel said. "That's the reason they each gave, but is it the right one?"

"Those brains were as perfect as any ever born," Flattery said, and he wondered why he allowed Bickel's attitude to irritate him. "Okay, they were raised from infancy as part of the total ship-sensor-servo system. So what? They didn't know any other life or want . . ."

"You said a couple of things were bothering you," Timberlake interrupted. "What's the other one?"

"Your life systems report," Bickel said, "entry 91007 on Myrtle. It says: 'None of the systems appear then to have been at fault.' Why'd you use that word *appear,* Tim? You have some doubts you couldn't enter in the report?"

"Not a damn' one!" Timberlake said. "Those systems were perfect!"

"Then why didn't you just say so?"

"He was only being cautious," Flattery said. "If you've checked the records, you'll find my medical report confirms his findings in every respect."

"Except one," Bickel said.

"And *what* is that?" Timberlake asked. He glared at Bickel, his face flushed. A muscle worked along his jaw.

Bickel ignored the signs of anger, said: "Nothing explains the internal burn damage that Raj found in those brains. 'Internal burn damage,' you say, 'especially along the overlarge axon collaterals of the afferent side.' What the devil do you mean *overlarge?* Overlarge compared to what?"

"A main channel leading into the brain's higher centers was about four times the size of anything I'd ever seen," Flattery said. "I don't know why, but I can guess it was compensatory growth. These OMCs had to

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handle many more incoming data bits from more sensors than the normal human ever encounters. You'll note that the frontal lobes were larger, too, but . . ."

"The design specs on the OMC process explain all that," Bickel said. "Compensatory growth, yeah, but I don't find word one about large axon collaterals. Not word one."

"These brains had been in the system longer than any others ever examined," Timberlake said. "The literature only reports on four previously that died of natural causes."

"*Natural* causes?" Bickel asked. "What's a natural cause fatal to an OMC?"

"You know as well as I do," Flattery said. "Accidents. Irritant matter in the food bath. A radiation shield left down. But you'll notice that the last words from each betrayed a type of deterioration akin to schizo . . ."

"Akin!" Bickel sneered. "That's what you see all through these damn' reports: 'Something similar to . . .' 'A condition that reminds one of . . .' 'Akin to . . .'" He glared from Flattery to Timberlake: "The truth is we don't know what the hell goes on in an OMC's gray matter."

A clicking-buzzing erupted from the master board above Flattery.

Bickel waited while Flattery fought out a manual temperature adjustment in an inner hold. Presently, Flattery wiped perspiration from his forehead, studied his gauges to be certain the balance was holding.

"Man, that board's murder," Timberlake muttered. "I don't wonder those OMCs caved in."

Flattery risked a glance away from the board, said: "You know better than that, Tim. This part of the job was child's play for a functioning OMC. They could handle most ship homeostasis problems by something akin to reflex action."

"Akin," Bickel said.

"All right!" Flattery barked. "I was just saying—"

He broke off as the Master board grew three diagonal stripes of flashing yellow. Flattery's hands darted to the controls as Bickel shouted: "Grav shift!" and dove for his couch.

Cocoon snapped closed around them and they felt the creeping, jerking weight shifts, the runaway fluctuation of the field-centering system—the unexplained gravity variance that had killed Maida.

Bickel watched Flattery's hands fight the system back into balance with a surgeon's sureness. The tugging and jerking began to ease. Presently, Flattery made a fine, adjustment

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in the centering controls, took up as though there'd been no interruption. "Myrtle, you will recall, said: 'I have no incarnation.' That may have been the only accurate thing in her jabbering. After all, except for gray matter, she had no flesh. But then, remember, after a long silence she said: 'I'm counting my fingers.' She had no fingers, no conscious memory of fingers. And that final question: 'Why are you all so dead?' The best guess is that any meaning in these statements and questions was purely accidental."

"I think she was referring to us, to the crew," Bickel said. "It's nuts, yes, but it was a direct question over the vocoders and we were the only possible audience."

"Unless she was referring to the colonists in the hyb tanks," Flattery said. "They might appear dead under some . . ."

"Myrtle had direct contact with the hyb tank sensors," Timberlake said. "She'd have known if they were alive."

Bickel nodded, said: "What do you make of Little Joe roaring over every vocoder in the ship: 'I'm awake! God help me, I'm awake!"

"A cry for help, perhaps," Flattery said. "Most insane raving is a cry for help in one form or another."

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"That leaves Harvey," Bickel said. "Harvey screamed: 'You're forcing me to be unhealthy.'"

"Easy does it," Flattery said. "That was just another nonsense statement."

"We all knew what it meant, though," Bickel said. "I didn't see anybody showing surprise when Harvey said; 'I've lost it!' and signed off . . . permanently. We'd been expecting it; you know that. And there we were with three dead brains and no spares."

The bald, callous way Bickel put it sent a shuddering sadness through Timberlake and he couldn't explain it. He'd never been deeply attached to the OMCs. There'd always been something faintly accusing about the "ship creatures." Raja Flattery had assured him this was strictly subjective, something from his own attitudes. Raj had always been so positive that the OMC - ship - computer entities were perfectly reconciled to their way of life, happy with their own compensations.

What compensations? Timberlake wondered. *Expectancy of long life? But what's three or four thousand years of living if each year is hell?*

Sharp, heavy G force pressed him against the side of his couch cocoon. It struck without klaxon warning or alarm light. Cocoon safety locks sealed home. Now, red alarm lights flashed with the yellow in long webs across the master board.

Flattery slammed the gravity disconnect with the heel of his left hand. G force ebbed. Yellow alarm lights winked off as their pressure switches released. A line of red alarm lights remained.

"Damage to hull three, section six-fourteen," Flattery said. He began activating remote sensors to inspect the area.

Without conscious thought or discussion, Bickel took over ship command, said: "Tim, take the G repeaters. Leave gravity disconnected while you trace the relays and get the system back in balance."

Timberlake pulled his board close to obey.

Bickel swung the AAT board to his side, keyed for ship systems-computers control, began feeding coded demands into the core recorders. What had the ship encountered that might explain that brutal deflection? What had the automatic sensors recorded?

The responders began kicking out tape almost immediately — much too fast.

"Data error," Flattery said, reading the output over Bickel's shoulder.

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In abrupt fury, Bickel pulled the master override stop from his core switch, jammed a set of jumper packs across the AAT controls, opened the core system for standard reference comparison.

"You're into the core!" Flattery said, his voice sharp with fear. "You've no guide fuse or master reference. You could louse up the command routines."

"Unhook that!" Timberlake shouted, lifting his head from the cocoon clamps to glare across at Bickel.

"Shut up, both of you," Bickel said. "Sure, the core's delicate, but something in there's already loused up—bad enough to kill us."

"You think you've time to check some eight hundred thousand routines?" Timberlake demanded. "Don't talk nuts!"

"There're specific injunctions against what you're doing," Flattery said, fighting to keep his voice reasonable. "And you know why."

"Don't try to tell me my job," Bickel said.

While he spoke, Bickel rolled over core memory responders, direct contact, doing it gently to avoid current backlash.

"You make one mistake," Timberlake said, "and it'd take six or seven thousand technicians with a second master system and several thousand imprint relays to repair the damage. Are you ready to . . ."

"Stop distracting me," Bickel said.

"What're you looking for?" Flattery asked, interested in spite of his fear. He had realized that Bickel, conditioned to deep inhibitions against turning back, was incapable of doing anything to deprive them of one of their basic tools.

"I'm checking availability of peripherals from the core memory," Bickel said. "There's got to be a bypass or pile-up somewhere. It'll show in the acquisition and phase-control loops of the input." He nodded toward a diagnostic meter on his board. "And here we are!" The meter's needle slammed against its pin, fell back to zero, stayed there.

Slowly, Bickel ordered a master diagnostic routine into direct contact, forced the routine through the data reference channels as modified by new sensor input.

Error branchings began clicking from his responders. Bickel translated aloud as the code figures appeared on the screen.

"Core memory/prediction region rendered inactive. Proton mass and scatter relative to ship course/mass/speed did not agree with prediction."

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Aside, Bickel said: "We're hitting something other than hydrogen and hitting it in unexpected concentrations — partly because of our speed/mass figure."

"Solar winds," Timberlake whispered. "They said we . . ."

"Solar winds, hell!" Bickel said. "Look at that." He nodded at a code grouping as it worked its way across the screen.

"Twenty-six protons in the mass," Timberlake said.

"Iron," Bickel said. "Free atoms of iron out here. We're getting a plain old-fashioned magnetic deflection of the grav field."

"We'll have to slow the ship," Timberlake said.

"Nuts!" Bickel said. "We'll put a fused overload breaker in the G system. I don't see why the devil the designers didn't do that in the first place."

"Perhaps they couldn't conceive of any force large enough to deflect the system," Flattery said.

"No doubt," Bickel said, his voice heavy with disgust. "But when I think a simple cage switch with a weight in it could have prevented Maida's death."

"They depended on the OMC's reflexes, too," Flattery said. "You know that."

"What I know is they thought in straight lines when they should've been thinking in the round," Bickel said.

He unlocked his safety cocoon, shifted his suit to portable, launched himself diagonally across Com-central to the Tool & Repair hatch. The weightless drifting reminded him they had a time limit on returning to gravity conditions. Too long without gravity and the crew would suffer permanent physical damage. They had perhaps another hour and a half to be on the safe side.

Bickel grabbed the hatch handle, swung out the repair traveler. He worked silently, angrily, with swift, decisive movements and presently had a cage switch clamped beside the main power cable into the gravity generator. He made the connections to the breaker, tested the circuits with a false load, replaced the cover plate.

"It'll have to be reset manually each time," he said. He put a foot against the bulkhead, propelled himself back to his couch, locked in, glanced at Timberlake. "System balanced?"

"Near as you can tell from here," Timberlake said. "Give it a try, Raj."

Flattery checked to see that both Timberlake and Bickel were sealed in their cocoons, closed the gravity switch. The sound of the generators building

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up grew to a faint hiss that subsided as the system stabilized. Flattery felt the pressure against his shoulderblades, reached up to the board, slowly refined Timberlake's settings.

"Tim," Bickel said, "I want the schematics for the OMC chamber—every sensor-tie coded for function—and laid out in layers from gross to fine. I'll need the same thing for servo control, a complete . . ."

"Why?" Timberlake asked.

"Are you thinking of tieing in a colonist's brain?" Flattery demanded, trying to hide his feelings of increasing outrage at the idea.

"A mature human brain probably wouldn't survive such a transfer," Timberlake said. And he felt shame at how much the thought had appealed to him. Every inhibition of his training cried out against such a move. But if the OMC system were restored, none of them here ever again would have to undergo the nerve-crushing responsibility of that Com-central master board.

"What the hell!" Bickel snapped. "Where'd you two get that idea? Not from anything I—said."

He broke off as the high pitched hummm-buzzz-hummm of the AAT receiver filled the room, alerting them that a message was being processed.

The message-ready chime sounded. Bickel keyed the vocoder. The voice of Morgan Hempstead, United Moonbase director, rolled out of the speakers, recognizable and still with its iced iron overtones preserved by the AAT's comparators.

"To UMB ship *Earthling* from Project Control. This is Morgan Hempstead. We hope you understand our distress and concern. Every decision from this point must have a prime motive of preserving the lives of yourselves and the colonists."

So much for the record, Flattery thought. *There are seven nations and four races represented in the hyb tanks—but all just as expendable as the ones who went before us.*

"We have several prime questions," Hempstead said.

I've a few questions of my own, Bickel thought.

"Why was Project Control not alerted when the first Organic Mental Core failed?" Hempstead asked.

Bickel mentally logged the question. He knew the answer, but it was nothing he'd ever transmit. Hempstead knew it as well as he did. The *Tin Egg* had momentum as an idea that had survived six failures. Nothing short of another ultimate failure would stop it. Nothing short of desperate emergency

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could make them risk aborting the mission by calling for help.

"Doppler reference indicates you'll be out of the solar system in approximately three hundred and sixteen days at present stabilized speed," Hempstead said. "Time to Tau Ceti: four hundred-plus years."

As he listened, Bickel pictured the man behind the voice: flint-like face with gray hair and gray-blue eyes—that aura of momentous decision even in his smallest gesture. The psych boys had called him "Big Daddy" behind his back, but they'd jumped when he commanded. Now, Bickel focused on the fact that they never again expected to see Hempstead, yet the man still could reach into their midst with his decisions.

"First analysis indicates these possibilities," Hempstead said. "You could turn back to orbit around UMB until the problem is solved and new Organic Mental Cores installed. That would return us to the old problem of sterile control under less than ideal conditions. It also would remove the ship from the situation of probable cause in the OMC breakdowns, perhaps making solution impossible."

"He always was a long-winded bore," Timberlake said.

"Second possibility," Hempstead said, "would be for you to convert to a closed ecology and continue at present speed, enlisting replacements from your hybernation tanks or breeding and raising your own crew complement. However, food would be a major problem unless you adopted a more closely integrated recycling system."

"Closely integrated recycling," Flattery said. "He means cannibalism. It was discussed."

Bickel turned to stare at Flattery. The idea of cannibalism was repellant, but that wasn't what had caught Bickel's attention. "*It was discussed.*" That simple statement contained volumes of unanswered questions and hidden implications.

"Third possibility," Hempstead said, "would be to build the necessary consciousness into your robo-pilot, using the ship computer as a basis. Our computations indicated you have sufficient materials, including neuron packages intended for colony robots in your stores. This is theoretically feasible."

"Theoretically feasible!" Timberlake sneered. "Does he think we've never heard about all the failures in . . ."

"Shhhh," Flattery hissed.

"Project Council suggests you continue present course and speed," Hempstead said, "as long as you are within the solar system. If a solution has not

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been reached by then, present opinion is that you will be ordered to turn back." There followed a long silence, then: ". . . unless you have alternative suggestions."

"*You will be ordered to turn back,*" Flattery thought. He turned to see how those key words sat with Bickel. They were aimed at Bickel, contrived for him, fitted specially to trigger his deepest motives.

Bickel lay in thoughtful silence staring up at the speech microscope display above the vocoder, checking the accuracy of message reception.

"At this time," Hempstead said, "Project Control requires a detailed report on condition of all ship systems with special reference to hybernating colonists. It is recognized that prolonging the voyage increases probability of hybernation failure. We recognize that you must replace crew losses from the tanks. Suggestions on replacements will be made upon request. We share your grief at the unfortunate accidents among you, but the Project must continue."

"Detailed report on all ship systems," Timberlake sneered. "He's out of his mind."

How cold was Hempstead's commiseration, Flattery thought. The phrasing betrayed the care with which it had been composed. *Just enough grief; not too much.*

The vocoder emitted a filter-dulled crackling, then: "This is Morgan Hempstead closing transmission. Acknowledge and answer our questions immediately. UMB out."

"They left too much unsaid," Bickel said. And he sensed there'd been "deletions for reasons of policy" all through the message. The thin political line they walked had been betrayed most in what was not said.

"Build consciousness into our computer," Timberlake growled. "How stupid can they get?" He glanced at Bickel. "You were on one of the original attempts at UMB, John. You get the honor of telling 'Big Daddy' where he can shove that idea."

"That attempt flopped and badly," Bickel agreed. "But it's still the only real course open to us."

Timberlake raged on as though he hadn't heard: "There were people on the UMB fiasco who make us look like a pack of amateurs."

Flattery had heard, though, and he hid a knowing smile by turning away and speaking mildly: "We all read the report."

"The only part worth reading was their summation," Timberlake said. He pitched his voice in a sneering falsetto: "'*Impos-*

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sible of achievement at present level of technology.'"

"That was an excuse, not a summation," Bickel said. And he thought back to UMB's fruitless search for the artificial Consciousness Factor. There'd always been that sterile wall between his part of the group and the Station personnel, but the triple-glass walls had never hidden the smell of failure. It'd been all around the project from the beginning. They'd been lost in tangles of pseudoneuron fiber, in winking lights and the snap of relays, the hiss of tape reels and the bitter ozone smell of burnt insulation from overloaded circuits. They'd looked for a mechanical way to do what the least among them could do within his own flesh—be conscious.

And they'd failed.

Over them all had hung the unspoken fear, the knowledge of what'd happened to the one project that reportedly had achieved success . . . and its own doom . . . back on the surface of earth.

Timberlake cleared his throat, lifted a hand out of his couch cocoon, studied his fingernails and picked up the threads of a previous conversation: "There was no physical reason for those brains to fail. The life systems were perfect. It's as though they committed suicide . . . under some unknown stress."

IV

She had come into Com-central still feeling weak and disoriented. It was obvious that the shift of dominance had gone faster than expected, though, and she had forced herself to overcome her body's weaknesses, putting on a mask of well-being and composure that she did not feel.

The ovoid Com-central room should not have confused her—she had put in too many hours of training among these dials and gauges and pipes and keyboard consoles before their departure—but the feeling of unfamiliarity persisted. Then, as awareness increased, she saw the subtle changes in connections and controls and readouts, recognized Bickel's handiwork.

All the changes were necessary to put the ship on manual, she realized, but she could feel the inadequacies of what had been done.

It was then she realized the thin edge they walked, and she turned her attention to Flattery who was finishing out his shift on the big board. The signs of strain were obvious in his movements—still exact with a surgeon's sureness, but the control betrayed its thinning energy in the way he relaxed abruptly after each adjustment of the board.

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He should be relieved now, she thought, but she knew she was not yet ready to have that green dial point down at her, and she wasn't sure of the conditions of Bickel and Timberlake.

Timberlake radiated glum silence.

"Moonbase is taking longer to answer this time than it did before," she said.

"They're too busy trying to decide what our reply *really* means," Bickel said. "And I gave 'em some questions to answer."

"Or they could be figuring out how to tell us we've bitten off more'n we can chew," Timberlake said.

She heard the fear in his voice, said: "Raj has been on that board over four hours. Isn't it time somebody spelled him, Tim?"

Flattery knew what she was doing, but couldn't prevent the feeling of tension from gripping his spine. There was always the possibility Timberlake couldn't take this.

Timberlake felt the dryness in his mouth. Naturally, she'd assume he was giving orders here. He was the life systems man. She hadn't volunteered to take the board, either . . . the bitch. But maybe it was too soon after de-hyb. Metabolisms differed. She'd know her own capacities, certainly. Besides, she was scheduled to follow Bickel on the board in the normal rotation.

His glance followed the Comcentral track, the way the board circled around their positions. Bickel was in number one spot, then Prue, then Flattery—and he sat here on the end.

It's my watch, Timberlake told himself.

He felt perspiration start in his palms.

He's taking too long, Flattery thought, and he said: "I'll give you the board on the count, Tim. I'm wearing pretty thin."

Before Timberlake could protest, the count had started and his hand went automatically to the big red switch. Board and arrow came to him. Necessities of the job caught him immediately. Almost a third of the shield temperature control needed trimming to bring it into better balance.

We should trace out the OMC linkages for this and install automatics for the gross part of the job, he thought.

Presently, he fell into the routine of the watch and realized he'd be able to take his four hours . . . at least.

Prudence was studying Bickel's displays and stacks of schematics. She had followed enough of what he was doing there to

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combine that with the programming he had handed her and conclude one major fact. The device he proposed would yield products of the Hermite polynomials and Laguerre co-efficients of the past of the inputs. It was the same old self-reflexive circle every time they faced this problem—where did the circle of consciousness begin?

"Maybe I can handle it," she said—"if you'll define consciousness for me."

"We'll leave that up to the bigdomes at UMB," Bickel said.

"We're not going to touch the inner communications lines of the computer. Our auxiliary will go into it through a one-way channel, fused against backlash."

"And there's no way for this auxiliary to run wild?" Flattery asked.

"Its supervisory program will always be one of us," Bickel said, fighting to keep irritation from his voice. "One of us will always be in the driver's seat. We'll drive it—like an ox pulling a wagon."

"This ox won't have any ideas of its own, eh?" Flattery asked.

"Not unless we solve the consciousness problem," Bickel said.

"Ngaaa!"

Flattery's word pounced.

"And when it's conscious, what then?" he asked.

Bickel blinked at him, absorbing this. Presently, he said: "I . . . suppose it'll be like a newborn baby . . . in a sense."

"What baby was ever born with all the information and stored experiences of this ship's master computer?" Flattery demanded.

Bickel's being fed this too fast, Prudence thought. *If he's kept too much off balance he may rebel or start to probe in the wrong places. He mustn't guess.*

"Well . . . the human *is* born with instincts," Bickel said. "And we do train the human baby into . . . humanity."

"I find the moral and religious aspects of this whole idea faintly repugnant," Flattery said. "I think there's sin here. If not hubris, then something equally evil."

Prudence stared at him. Flattery betrayed signs of real agitation—a flush, in his cheeks, fingers trembling, eyes bright and glaring.

That wasn't in the program she thought. *Perhaps he's tired.*

Flattery shifted his attention from Bickel to Prudence and back. He found it increasingly difficult to hide his resentment of Bickel.

Psychiatrist, heal thyself, he thought. *Bickel has to take charge. I'm just the safety fuse.*

Flattery glanced at the false plate on his personal repeater

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board, thinking of the trigger beneath that plate and the mate to it in his quarters concealed by the lines of the sacred graphic on the bulkhead.

"*Arbitrary turn-back command,*" Flattery reminded himself. That was the code signal he must listen for from UMB. That was the signal he must obey—unless he judged the ship had to be destroyed *before* receiving that signal.

A simple push on one of the hidden triggers would activate *the* master program in the ship's computer, open air locks, set off explosive charges. Death and destruction for crew, ship, all the colonists and their supplies.

Colonists and their supplies! Flattery thought.

He was too good a psychiatrist not to recognize the guilt motives behind the careful provisioning of this ship. And he was too good a divine not to see through the religious hokum to the essential *rightness* of his role on this project.

There had to be a safety fuse.

The first crude attempts at mechanical reproduction of consciousness had been made on an island in Puget Sound. The island no longer existed. "*Rogue consciousness!*" they had screamed. True enough. Something had defied natural laws, slaughtered lab personnel, destroyed sensors, sent slashing beams of pure destruction through the surrounding countryside.

Finally, it had taken the island —God knew where.

Poof!

No island.

No lab personnel.

Nothing but gray water and a cold north wind whipping whitecaps across it and the fish and the seaweed invading the area where land and men and machinery had been.

Just thinking about it made Flattery shiver. He conjured up in his mind the image of the sacred graphic from his quarters, absorbed some of the peace from the field of serenity, the tranquility of the holy faces.

Even Moonbase didn't walk too close to this project now. It was all a sham to educate ship personnel, to frustrate the eager young men and women.

"*Each project ship must maintain its coefficient of frustration,*" went the private admonition. "*Frustration must come from both human and mechanical sources.*"

They thought of frustration as a threshhold, a factor to heighten awareness.

It made a weird kind of sense.

Thus, there were crew members like Flattery . . . and Prudence Weygand, and machinery

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that broke down, robox repair units that had to have a human monitor every second—and programmed emergencies to complicate real emergencies.

Flattery longed to get back to his quarters, to bathe himself in the field generator there, examine the *mood* of the computer complex and be certain it had settled back to pure mechanism since deprived of its Organic Mental Cores.

But he could not leave here yet, could not display any suspicious behavior.

"If you start rebuilding systems," Prudence was saying, "how long would it take to restore communications?"

"Fifteen to twenty hours," Bickel said. "We could have a jury rig in doing the job by then."

Flattery looked questioningly at Timberlake.

"That's about right," Timberlake agreed.

"We use the AAT as a basis for our simulator," Bickel said. "We'll raid colony stores for reels of neuron fiber, Eng multipliers and the other basic components. What we have to get is a system that simulates human nerve net function."

"But will it be conscious?" Flattery asked.

"All we can do is cut and try," Bickel said. "Our computer and even the AAT work on analogue additive principles. We're going to build a system that's strictly infinite-multiplying. Our system will produce message units that are products of many multipliers."

"You make it sound so simple," Prudence said. "Connect net A to net B at points D and D prime and you get the Consciousness Factor—CF for short."

Bickel's lips thinned. "You have a better plan?"

Did I push too hard? she wondered. And she spoke quickly: "Oh, I'm with you, Bickel. You obviously know all the answers."

"I *don't* know all the answers," Bickel growled, "but I'm not going to sit out here moaning about fate . . . and I'm not turning back."

What if we have to turn back? Flattery wondered. *What do we do about Bickel's inhibition then?*

"Are you going to wait for Moonbase to answer?" Flattery asked.

Bickel glanced at Prudence. "I'd prefer starting at once, but that means I'd miss my shift on the board . . . and since I'll need Tim . . ."

"We can handle it," Flattery said. "Everything seems to be running smoothly."

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Prudence looked up at the big board and the inactive repeaters over her couch, wondering at her sudden feeling of chill. *I'm afraid to take that board,* she thought.

Those thousands of lives down in the hyb tanks . . . all depending on right-the-first-time reactions. *Did the UMB bigdomes really know what they were doing when they sent us out here? Was this the only way?*

For the first time since coming out of the hyb tank, she felt the old familiar pain-of-wonder, asking herself what it might've been like to've been born into a normal family in the normal way, to have grown up in the noisy, intimate *belonging* of the unchosen.

"*You are the cream, the select few,*" Morgan Hempstead and his cohorts had kept reminding them. But she was one of the select few who knew where the cream had originated. Most of the medics on the ship knew. Normal biopsy tissue from a living human volunteer had been suspended in an axolotl tank, the genetic imprint triggered and the flesh allowed to grow. It produced an identical twin—an expendable twin.

Select few! she thought. *Something precious was taken from us and the compensations were inadequate.*

She tuned the small screen at the corner of her board to one of the tail eyes, looked back toward the center of the solar system, toward the planet that had spawned them.

A stabbing pang of homesickness tightened her breast, made breathing difficult.

They had been moulded and motivated, twisted, trained and inhibited—wound up like mechanical toys and sent scooting off into the darkness with their laser "whistle" tooting to let UMB know where they were.

And where are we? she asked herself.

"Prue, you'd better take the big board," Flattery said. "You'd normally follow John."

Sight of the big board's dials and gauges filled her with an abrupt anger and fear. She felt the immediacy of the emotions in a dry throat, heat in her cheeks.

"I . . . haven't had enough time off the board . . . to recuperate," Flattery said, speaking hesitantly. "Or I'd . . ."

"It's all right," she said. "I'll take it."

V

In Com-central, the sounds were those the umbilicus crew had come to accept as normal—the crack of action couches in their gimbals, the click of an occasional relay as it called at-

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tention to a telltale on the big board.

"Has Bickel unburdened himself at all about the artificial consciousness project at UMB?" Prudence asked.

She removed her attention momentarily from the master console, glanced at Flattery, her sole companion on the lonely watch. Flattery appeared a bit pale, his mouth drawn downward in a frown. She returned her attention to the console, noting on the timelog that her shipwatch had a little more than an hour yet to run. The strain was beginning to drag at her energy reserves. Flattery was taking a hell of a long time to answer, she thought . . . but he was famous for the ponderous reply.

"He's said a little," Flattery said, and he glanced at the hatch to the computer maintenance shop where Bickel and Timberlake were working. "Prue, shouldn't we be listening in on them, making sure they . . ."

"Not yet," she said.

"They wouldn't have to know we were listening."

"You underestimate Bickel," she said. "That's about the worst mistake you can make. He's fully capable of throwing a trace meter onto the communications —as I have—just on the off chance something interesting'll turn up."

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"D'you think he's started . . . building?"

"Mostly preparation at this stage," she said. "They're collecting material. You can pretty well follow their movements by watching the power drain here on the board, the shifts in temperature sensors and the dosimeter repeaters and the drain on the robox cargo handlers."

"They've been out into the cargo sections?"

"One of them has . . . probably Tim."

"You know what Bickel said about the UMB attempt?" Flattery asked. He paused to scratch an itch under his chin. "Said the biggest failure was in attention —the experts wandering away, doing everything but keeping their attention on the main line."

"That's a little too warm for comfort," she said.

"He may suspect," Flattery said, "but he can't be certain."

"There you go underestimating him again," she said.

"Well, at least he's going to need our help," Flattery said, "and we'll be able to tell what's going on from *how* he needs us."

"Are you sure he needs us?"

"He'll have to use you for his deeper math analysis," Flattery said. "And me . . . well, he's going to be plowing through the von Neuman problem before he gets much beyond the first steps. He may not've faced that yet, but he'll have to when he realizes he has to get deterministic results from unreliable hardware."

She turned to stare at him, noting the far away look in his eyes. "How's that again?"

"He has to build with non-living matter."

"So what?" She returned her attention to the board. "Nature makes do with the same stuff. Living systems aren't living below the molecular level."

"And *you* underestimate . . . life," Flattery said. "The basic elements Bickel has to use are from our robot stores—reels of quasi-biological neurons and solid-state devices, nerex wire and things like that—all of it non-living at a stage far above the molecular."

"But their fine structure's as relevant to their function as any living matter's is."

"Perhaps you're beginning to see the essential hubris in even approaching this problem."

"Oh, come off that, *Chaplain,*" she said. "We're not back in the Eighteenth Century making Vaucanson's wonderful duck."

"We're tackling something much more complex than primitive automata," he agreed, "but our intention's the same as Vaucanson's."

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"That's absolutely not true," she said. "If we succeed and took our machine back to Vaucanson's time and showed it to him, he'd just marvel at our mechanical ability."

"You miss the mark," Flattery said. "Poor Vaucanson would run for the nearest priest and volunteer for the lynch mob to do away with us. You see, *he* never intended to make anything that was really alive."

"It's only a matter of degree, not basic difference."

"He was like Aladdin rubbing the lamp compared to us," Flattery said. "And even if his intentions *were* the same as ours, he wasn't aware of it."

"You're talking in circles," she said.

"Am I, really? This is the thing that writers and philosophers have skirted for centuries with their eyes half averted. This is the monster out of folklore, Prue. This is Frankenstein's poor zombie and the Sorcerer's Apprentice. The very idea of building a conscious robot can be faced only if we recognize the implicit danger — that we may be building a Golem that'll destroy us."

"Oh, for God's sake, Raj!" Prudence said. "Have you completely forgotten that you're a scientist?"

"For God's sake, I can never forget it," he said.

He glared at her. His throat felt dry and burning.

"You're supposed to be doing this to me, aren't you," he accused. "You're supposed to push me and test me, give me no peace. I know."

How little he knows . . . or even suspects, she thought.

Flattery stared at the curved gray metal of the bulkhead above him, seeing the tiny imperfections in the crackle pattern of its finish. He felt he was being maneuvered. She was stalking him the way a man might stalk game. Was it his soul she was after? He sensed he was in profound danger, that the idea of consciousness as something they could create might inflict itself on his soul as an incurable wound.

He put a hand to his mouth. *I cannot permit her to bait me and tempt me.*

"Raj," she whispered and there was terror in her voice.

He whirled toward her, seeing the streaks of light across the big board like red knife slashes.

"We're almost at red-line temperature in Sector C-8 of the hyb tanks," she said. "Everything I do seems to make the system oscillate."

Flattery's hands flashed out to the life systems repeater

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switches, brought his own monitors alive. He scanned the instruments, said: "Call Tim."

"Nothing I do seems to work!" she panted.

He glanced at her, saw she was fighting the board, not working with it.

"Call Tim!" he barked.

She hit the command circuit switch with the heel of her left hand, shouted: "Tim to Com-central! Emergency!"

Again, Flattery scanned his instruments. There appeared to be three points of temperature shift outside the hyb tanks with corresponding variation inside. As Prue tried to compensate for one fluctuation, the others fell farther toward the red.

He had to force himself to keep his hands off the controls. If tank temperature went into the red without dehyb precautions, there'd be deaths among the helpless occupants. Despite Prue's desperate efforts, death was approaching three sectors of the C-8 tank — some four hundred human lives in there.

The hatch from the computer shop banged open. Timberlake leaped through with Bickel right behind.

"Hyb tanks," Prudence gasped. "Temperature."

Timberlake threw himself across Com-central into his action couch. His vacsuit rasped against the cocoon lips as he turned, grasped the traveler controls. "Give me the red switch," he snapped. "To hell with the count! I'm taking it."

And he took it, the big board swinging across much too fast.

"C-8," she said, sinking back and wiping perspiration from her forehead.

"I've got it," he said. He scanned the dials and gauges, his fingers playing over the console.

Bickel slipped into his own couch, tripped his repeaters. "It's in the hull shielding," he said.

"First two layers," Timberlake said.

Prudence put a hand to her throat, tried not to look at Bickel. *He mustn't suspect our attention's on him,* she thought. Then: *Wouldn't it be monstrous irony to lose our colonists and burden ourselves with guilt before the need for it?*

"That's doing it," Bickel said.

She looked across to the board above Timberlake, saw the warning telltales winking out, the dials swinging back into normal range.

"Faulty feedback for a patch of our shell reflectors focused on C-8," Timberlake said. "The system started to oscillate and that threw the overload switches, left us wide open."

"Another *design failure,*" Bickel sneered.

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And such a simple problem, Bickel thought. The hull curve acted like a lens to focus energy within the ship . . . unless reflector and shell shielding systems compensated.

Prudence traced the line of the remaining telltales, said: "C-8's on a line with that robot stores section you were raiding. Is that all it takes to throw the ship off balance?"

"Gives you a wonderful feeling of confidence in the Tin Egg's design, doesn't it," Bickel said.

They didn't warn me! she thought. *They cheated. Calculated emergencies, they said, just enough to keep a fine edge on your reaction abilities. Reaction abilities!*

"You overcompensated, Prue," Timberlake said. "Make minimal adjustments to avoid oscillation while you hunt for the source of your trouble. You had sensor telltales flaring right out through the ship to pinpoint where you needed shielding reinforcement."

I panicked, she thought. And she said: "I guess I let myself get too tired." Even as she spoke she sensed how lame the excuse sounded.

I was too intent doing the job on Flattery, she thought. *I had him headed for a nice corner where he'd have to fight his way out . . . and I missed the ship trouble until it was almost ready to wreck us.*

It occurred to her then to wonder if one of the crew had *her* as a "special project" to keep her abilities toned up . . . on edge.

"Prue, you've got to remember that when the overload switches go the computer automatics are out of the circuit," Bickel said. "This thing was designed to be brought back into line by a conscious intelligence — one of us or an OMC."

"Oh, shut up!" she flared. "I made a mistake. I know it. I won't do it again."

"No damage was done," Timberlake said.

"I don't need you to defend me!" she snapped.

"That's enough of that!" Bickel snapped, turning to glare at Prudence. "We'd better clear a little air, here. We're on our own, Prue. You've no idea how much on our own we are. We have to depend on each other because we sure as hell can't depend on the *Tin Egg!* We can't afford to snap and bite at each other."

Oh, can't we now, she thought.

"We're trapped on a ship that contains only one top drawer mechanism," Bickel said. "We've only one thing that functions smoothly and beautifully the way it should — our computer. Everything else works as though it'd

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been designed and built by six left-handed apes."

"Bickel thinks it was all deliberate," Timberlake said.

Prudence caught herself in an involuntary glance at Flattery, forced her attention away from Bickel and onto Timberlake. *This is far too early for Bickel to suspect,* she thought.

Timberlake avoided her eyes. He looked like a small boy who'd been caught stealing jam.

Flattery broke the silence. "Deliberate?" he asked.

"Yeah," Timberlake said. "He thinks the other six ships had the same kind of failure — something rotten with the OMCs."

Bickel's far more alert and suspicious than anyone suspected, Prudence thought. *Raj or I will have to side with him; there's no other way to keep control of the situation.*

"Why . . . the OMCs?" Flattery asked.

"Let's not tip toe around it," Bickel said. "The thing's obvious. What feature of these ships is never mentioned in the stress analyses trying to find a cause for the six previous failures? What feature do we assume is proof against failure because there's no hint of one breaking down?"

"Surely not the OMCs," Flattery said. He tried to hold his voice to a bantering level, failed and thought: *God help us. Bickel's seen through the sham far too soon.*

"Certainly the OMCs," Bickel said. "And they gave us three of the damn' things! One in service and two for back up. Never a hint that an OMC could fail, yet we had three on the Tin Egg!"

"Why?" Prudence asked.

"To make damn' sure we got beyond the point of no return before we got the cold-turkey treatment," Bickel said.

I guess I'm elected, Prudence thought. She said: "More of Project's goddamn' maneuvering! Sure. It'd be right in character."

Flattery shot a startled look at her, returned his attention to the big board before Bickel noticed.

"Cold turkey," Bickel said. "This ship's one elaborate simulation device with a single purpose — and my guess is the others were the same.

"Can't you see it?" Bickel asked. "Don't you recognize the purpose? It casts its shadow over everything around us. It's the only thing that makes any sense out of this charade. The secrecy, the mystery, the maneuvering — everything's calculated to put us on a greased slide into a very special ocean. It's not just cold turkey, it's sink or swim. And the only way we can swim is to develop an artificial consciousness."

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VI

She wrote her name: "Prudence Weygand" at the foot of the log tape, started it rolling through the auto-recorder, made the synchronous shift to Flattery's tape as he took over the board. The counter said it was her fifteenth change of shift.

Flattery squirmed in his couch, settling himself for the four hour watch. Reflections on the dial faces were hypnotic. He shook his head to bring himself to full alertness, heard the hiss of fabric as Prudence got out of her couch. She stood there a moment stretching, did a dozen deep knee bends.

How easily they accept the possibility that I'm the executioner, Flattery thought. He noted how wide awake and alert Prudence appeared. This four hours on-four hours off routine could be endured as long as no serious problems arose, but it played hob with the metabolic cycle. Prudence should be headed for food and rest, but she obviously was wide awake.

She glanced at Flattery, saw he was settled in for the watch, checked the repair log. Nothing was flagged urgent. That made it a bit more than twenty-five hours with nothing more than minor adjustments on the big board. Smooth. Too smooth.

Danger keeps you honed to a fine edge, she thought. *Extended peace makes you dull.*

"You'd better get something to eat and try to rest," Flattery said.

"I'm not hungry."

"At least try to rest."

"Maybe later. Think I'll wander in and see how Bickel and Tim're doing." She looked at the big screen overhead. It was tuned to the peak-corner lenses of the computer shop. And for all the four hours of her shift it had been producing provocative sights and sounds.

Bickel and Timberlake had been busy. She took one low-grav step across to the hatch-lock, let herself through and stopped to study what they had accomplished.

Timberlake was nowhere in sight. And where the optical character reader had been on the big panel across from the lock now stretched a mechanical excrescence — a piled and jutting structure of plastic blocks; Eng multiplier circuits, each sealed in plastic insulator. Linking the blocks were loops and tangles and twists of insulated pseudoneuron fiber.

Bickel had heard her entrance. Without turning from his work at one end of that protruding angular construction, he said: "Take that other micro-tie view-

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er on the bench. I need 21.006 centimeters of the K-A_4 neurofiber with random-spaced endbulbs and multisynapses. Connect it as I've indicated on that schematic labeled G-20. It should be the top one in that pile on the right end of the bench."

Bickel sat down on the deck, slid a new block of Eng multipliers into position. He swung a portable micro-tie viewer across the block, leaned into the viewer's forehead rests, began making the connections.

Yes, sir! she thought.

"We're almost ready to put this on an initial program," Bickel said when she had finished the assembly. He began connecting it to the newly installed Eng multiplier block, running one sheaf back to a plugboard connection on the computer panel.

Prudence stepped back, studied the mechanical growth that jutted from the wall. As though she saw it for the first time, the construction abruptly took on a new meaning for her.

"That's more than a set-up for analysis," she said.

"That's right, doll."

Bickel stood up, wiped his hands on the sides of his vacsuit, swung his own micro-manipulator and viewer to one side.

"This," Bickel said, "in addition to giving us our analysis of built-in misfunction, this little 'Ox' we're driving will provide a three-way energy interchange."

"You're tied into the computer," she accused, pointing to the connections to the plugboard.

"Every line in that board has a diode in it," Bickel said. "Pulses can come from the computer to our test set-up, but anything going into the computer has to be coded by one of us and inserted over there." He pointed to the input heads lined up at the right corner of the wall.

Prue turned to look at the overhead screen where Flattery was revealed calmly monitoring the big board. Something he had said came back to her full force:

"There's nothing concerning ourselves about which we can be truly objective except our physical responses, the reflections of behavior. We exist in a forest of illusion where the very concept of consciousness merges with illusion."

And Prudence thought: *To be conscious, you must surmount illusion. Bickel saw that where I didn't.*

She asked herself now how this applied to her own personal attack on their problem. The living chemistry of the body held clues to consciousness that had never been adequately explored. Neuroregulatory shifts in biochemistry

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triggered by consciousness expanders and hallucinogens had beckoned to experimenters before, but never in a situation paralleling a mechanical attack on the problem.

That avenue had to be explored, she knew — but she had only one guinea pig: herself. And tests on her own body with serotonin and adrenalin fractions were dangerous. She couldn't avoid the suspicion she might be giving in to a death wish.

Now, she wondered: *Am I deluding myself? Is this more illusion? Or is it just an excuse not to keep up the anti-S dosage so I'll become sexually desirable to Bickel?*

"That's it," Bickel said. "Let's give it a run. Prue, monitor the diagnostic board." He gestured to the panel of dials and gauges at the left of the plugboard. "I'll give each net potential of the roulette cycles a one-fifth second burst from the shot generator." He moved around to the right of the test set-up, flipped switches to start the source program through the inputs.

"Mark," he said.

"Mark," she said as her dials registered the pulse.

"Give me the mean synapse threshhold, mean endbulb threshhold and action time on each net," Bickel said. He depressed three switches simultaneously. "Interchange activated."

He waited, feeling the suspense grow as a tightness in his stomach.

"Interchange now showing entrance pulse," she said.

"Net one," he said, introducing the timed burst from the shot generator.

"There's a jam-up at the fifth-layer nodes," she said. "No impulses are getting through."

"I'll try sweeping the roulette cycles," Bickel said. He twisted a dial.

"Nothing," she said. "Still that fifth-layer jam-up."

Bickel stepped back, glared at the input panel. "This is nuts! What we have here is essentially a transducer. The outputs should match!"

Again, Prudence read her dials. "Your products are still zero," she said.

"Any heat?" Bickel asked.

"Nothing significant," she said.

"Somehow, we've produced a unitary orthogonal system for each net and the total assembly," Bickel said. "And that's a contradiction. It could mean we have more than one system in each of these separate nets."

"You have an unknown that's swallowing energy," Prudence said, her excitement kindling. "Isn't that our definition of . . ."

"It isn't conscious," Bickel

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said. "Whatever the unknown system is, it can't be conscious . . . not yet. This set-up is too simple, doesn't have enough source data. . ."

"Then it's some error in the hook-up," Prudence said.

Bickel's shoulders sagged. He took a deep, tired breath. "Yeah. Has to be."

"Where's your record of assembly and circuit tests?" Prudence asked.

"I isolated an auxiliary storage tank," Bickel said. He gestured vaguely to his left. "It's the red-flagged one. Everything's in there . . . including all this." He waved at the diagnostic panel.

"You get something to eat and take a rest-break," she said. "I'll start tracing circuits."

"We got a jam-up on the direct test," Bickel said. "It wasn't an open-circuit reaction. And the net-interchange test produces zero at the output without flagging the point of loss. The thing's a goddamn' sponge!"

"It'll be some simple error," she said.

Timberlake's head suddenly appeared from the hatch that led to the circuitry in the 'tween-decks crawl space. "It's down here," he said. "With the primary sheafs. Don't do anything for a minute."

He disappeared again. Meanwhile Prudence was scanning the print-out. With a sense of awe she realized that it was devoid of insignificant digits.

It had been weeded down to essentials.

"Yoh!" Timberlake called, his voice echoing with a hollow resonance from the crawl space.

Bickel looked down, saw that only Timberlake's feet protruded into the shop now.

"Found it," Timberlake said. "It's a fifty-line sheaf, single plug. Shall I pull it?"

"Where does it lead?" Bickel asked.

"According to the color code it leads right down into the accessory storage banks," Timberlake said. Timberlake's feet disappeared into the crawl space. "All these banks are linked that way! Why the hell doesn't it appear on the schematics?"

Bickel got down on his hands and knees at the mouth of the crawl hole, said: "Is there any kind of buffer or gating system in those lines?"

A hand light wavered back and forth in the crawl space. "Yeah, by god!" Timberlake said. "How'd you know?"

"Had to be," Bickel said. "This is a computer fail-safe device. Don't mess with it."

Bickel rocked back on his heels, fighting a lost, sinking sensation.

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Those bastards! he thought. *They knew we'd find this the first time we went looking into the computer's innards. They've tied our hands.*

"Come on out, Tim," Bickel said. "Don't change a damn' thing." He stood up, removed the blocking plugs he had inserted to isolate this storage bank.

Isolate! he thought. *Hah!*

All he'd done was change the potential at one point and insure that he wouldn't have the addresses on any of the test information they'd just sent into the system.

Timberlake scooted backward out of the crawl space, stood up. "Does that make sense to you?" he asked, gesturing toward the hole.

"I wish it didn't," Bickel said. "This computer has what amounts to a random address system as far as we're concerned. There'll be enormous blocks of information filed in it bit by bit in such a way that only the computer *knows* where it is. That's why we have so many special function routines and subroutines and sub-subroutines ad infinitum. The addresses of *those* we know."

"The organic cores must've known where the information was," Prudence said.

"And they're dead," Bickel said.

VII

Morgan Hempstead's burst-depersonalized voice filled the control room as Bickel started the playback of the new message from Moonbase.

"Calling UMB ship *Earthling*. This is Project calling UMB ship *Earthling*."

A long, rolling silence followed and they grew aware of the hissing of the tape as it sped across its sorting heads.

Bickel glanced around the room — Flattery at the big board yet, composed and so serenely sure of himself; Prudence in her action couch and with her eyes intent on the vocal translator at the AAT; Timberlake in his couch, eyes closed, breathing deeply. One might almost think he was asleep, but for the pulse at his temple. Bickel recognized that mannerism of Timberlake's. It meant the man was chewing over a heavy problem.

"Hit it," Hempstead said.

"That must be an error," Bickel said. "The AAT goofed on that one."

"We do worse ourselves sometimes," Flattery said.

"On the question of defining consciousness," Hempstead said. "Reference is made to nerve barrier and threshhold data your computer. Best dive to date."

"Best *definition* to date," Flat-

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tery said. "That's what he must have said."

"New Organic Mental Core," Hempstead said. "Medical personnel are directed to abandon all such repeats in their waste of order."

"There's something wrong with the AAT," Prudence said.

"Not with the AAT," Bickel said. "With the translator circuits from the computer."

"That goddamn' wild program we flushed through the system like a high colonic," Timberlake growled. He opened his eyes, stared accusingly at Bickel.

"Abandon all such attempts," Hempstead said. "Repeat: abandon all such attempts. This is a direct order."

"That sounds like him rightly enough," Prudence said.

"Under no circumstances are you to attempt to make inanimate components," Hempstead said.

"Try that one on your violin," Timberlake said.

"Analyze course and reaction data related to mass changes," Hempstead said. "Unknown area derived mathematically."

"Hash!" Timberlake snarled. "Garbage!"

"Project over and out," Hempstead said. "Acknowledge *year* compliance."

Timberlake sat up, swung his feet to the deck. "Go ahead, Bick," he said. "Acknowledge *year* compliance."

Flattery glanced at Timberlake, returned his attention to the board. Timberlake obviously was making a bid to regain his authority. That could've been predicted. Their first setback would bring him charging out — from fear for all those lives dependent on the life systems if not for any other reason. Flattery had watched the way Timberlake studied the life systems repeaters. Nothing wrong there . . . yet. But a threat to any part of the ship was a threat to all.

"Was he asking us to install a new brain?" Prudence asked.

"Where could we get one?" Timberlake asked.

"We've already been through that," she said, looking at each of them in turn.

And for the first time since taking her position with the umbilicus crew, Prudence allowed herself to wonder what it *really* would be like to become that fleshless embodiment, the mentality-central to a driving behemoth such as this ship.

She shivered.

They taunt me with blasphemy, Flattery thought.

"Are you cold, Prudence?" he asked.

He watches me all the time, she thought. The medical part of her faced the feminine part then,

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wondering if Flattery knew how she was twisting her body chemistry.

"I'm quite comfortable," she said.

But she wasn't comfortable. Moods of depression and elation shot through her without warning and had to be concealed. Strange psychic aches tortured her mind — fantasies of god-like power competed with the urge of physical abasement.

Bickel turned from the AAT with a length of printer tape, said: "Garbage."

"What else?" Timberlake snapped.

Flattery started to speak, froze in the act while he studied the track graph on his board. He hadn't imagined it; the graph was climbing. "We've been gaining speed for several minutes," he said. "Slow . . . but steady."

"Drive problems now!" Timberlake snarled.

Flattery activated the drive read-out, scanned it. "No," he said. "No emission. G/R level shows the normal radiation drop."

"Mass register?" Bickel asked.

Flattery's hands flicked over the keyboard. He scanned his gauges. "Out of register! Mass reference is out of register!"

"What are your readings?" Bickel asked.

"They vary through ten *argos*," Flattery muttered. "They don't graph back . . . no series-constant in the curve of change — Fourier or otherwise. Mass is out of register with speed."

"What'd Hempstead say?" Bickel demanded, looking back at the print-out tape. He quoted: "'Analyze course and reaction data related to mass changes.' If he . . ."

"That could be garbage!" Timberlake snapped.

"Still that gradual speed increase," Flattery said. "A slow increment for about four minutes now."

The ship is programmed for emergencies, Prudence thought. *That's what they said. But which are emergencies from that program . . . and which are emergencies from . . . the unknown?*

Flattery took a comparator read-out, said: "In the past minute and eight seconds, our speed has gone up .011002 against the fixed reference."

Bickel began shifting plugs on his computer board. His fingers danced over the keys. He checked the telltales, looked to the visual read-out screen. "It gives us wind-and-molecule analogy," he said. "If the range of individual molecular mass within a moving gas is less than that of an object in the path of the gas, the chance of collision between gas molecules

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and the *object* follows a probabilistic curve related to the mean difference in mass."

Timberlake coughed, said: "Is that thing saying our speed has raised our mass to a point where something is . . . colliding with us? That's nuts! We're being *pushed,* according to the track graph. What about things *we* hit, things in *our* path?"

"Maybe it's all going our way in this sector of space," Bickel said. "We don't know."

"Prepare for retro-firing," Flattery said.

"Wouldn't it be wiser to turn ship?" Timberlake asked. He kicked the manual cocoon switch and the action couch snapped securely around him.

"Raj's right," Bickel said. "Use minimum change. Something's happening for which we have no base of experience."

"I am starting retro with micro-emission," Flattery said. "Prue, monitor the track graph. Tim, watch our mass reference. I am recording for later analysis."

"If there is a later," Timberlake muttered.

Flattery ignored him, said: "John, monitor hull temperature and doppler comparison."

"Right." Bickel cleared his throat, thinking how crude was this quartered division of functions when compared with a properly working ship-control robobrain. The umbilicus crew was a pack of limping cripples by comparison . . . and in a situation where they needed to run and dodge and balance with the ability of an athlete.

"Starting retro," Flattery said evenly.

He moved the micro-controls one notch.

Action couches made a slight adjustment to the change. It registered as a creeping movement of their repeater consoles against the conduits, pipes and instruments of the fixed walls.

"Track graph report," Flattery said.

"Speed is dropping unevenly," Prudence said. "Fits and jerks."

Bickel, watching the edge of his repeater where it aligned with the edge of a wall plate, could see the bucking movement of the ship as a series of tiny jerks. His hands on the console keys sensed a tremor in the ship.

"Tell me when the graph levels off," Flattery said. "Mass reference report."

"Uneven," Timberlake said. "Graph average is dropping, but the direct register is going up and down . . . it's .008, .0095 . . . .0069 . . ."

"Let me know if it levels," Flattery said.

Without being asked, Bickel said: "There's a micro-increase

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in temperature along the first quadrant, stern. Compensation system is taking care of it adequately. Doppler reference shows an actual speed decrease of .00904 plus."

"Mark," Flattery said.

"S over C confirms," Prudence said.

Flattery advanced the micro-control another notch, feeling perspiration along his back and neck collecting too fast for his suit to compensate.

"Track," he said.

"Graph is now dipping below the fixed reference," Prudence said. "Still dropping unevenly."

"Ion reading," Flattery said.

"One over four point two eight double ought one," Timberlake said. "Agreement with emission rate is positive. Retro normal."

"Rate of down-graph is now even on the track," Prudence said.

"Mass reference level and .000001001 out of agreement," Timberlake said.

"Hull temperature?" Flattery said.

"Holding," Bickel said, and allowed himself a deep breath. Changes in hull temperature where they should not occur, changes in their speed without a positive explanation—these were more alarming than a physical breakdown that they could touch with their hands.

Flattery heard the sigh and thought: *The Tin Egg had a close call. But close to what? Does Bickel know? Did he tell us everything he got from the computer? Even so, how can we trust computer information now?*

But Flattery recalled another part of Hempstead's possibly-garbled message: *'Unknown area derived mathematically.'*

What if that were pretty close to Hempstead's actual words? Flattery asked himself. An unknown of some kind derived mathematically. The ship *had* encountered a mass/speed problem.

Bickel said: "Raj, drop the speed another two points and hold. We'll want regular checks on mass/speed variations from here on out."

"Complying," Flattery said. "Report in order." He turned to the micro-controls, dropped them two more notches.

"Track graph declines on an even slope," Prudence said.

"Mass reference agrees," Timberlake said. "Ion emission normal."

"Temperature holding normal," Bickel said. "Doppler comparison is positive-zero."

Bickel looked at those two thin black needles of the doppler comparator. They were what put the bite in this emergency. They provided positive checks on speed through doppler reference to

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fixed astronomical bodies. The doppler comparison and change in speed had agreed one-for-one.

"I do not understand what happened," Flattery said. "but I have the distinct feeling we were close to the brink."

"The brink of what?" Prudence demanded. Fear was plain in her voice.

"We were close to running wild out of the solar system," Bickel said. "Out of control, unable to maneuver. Quite likely, we were close to being hurtled into another dimension."

"Without a prayer of escape," Timberlake said.

"The negative transformations in grav theory," Prudence whispered.

"What?" Timberlake barked.

"The implicit energy exchange for enormous mass shifts near the speed of light," Prudence said. "The negative forms in the equations don't all cancel out until you build hypothetical transformations beyond the speed of light. There is a region of mass/speed change wherein two bodies theoretically repel each other rather than attract."

"Now," Bickel said, "how do we tell Hempstead and his boys about this without blowing the whole show?"

"We've already blown the whole show," Timberlake growled. "The computer . . ."

"Isn't necessarily wrecked," Bickel said. "Our life systems still work. Ship servos and sensors appear to be in order. I get consistent replies and demands for information."

"Consistent doesn't mean correct," Timberlake said.

"Was Hempstead telling us to cease and desist?" Flattery asked. "If he was . . ."

"We don't know," Bickel said. "As long as we don't know, we don't have to obey."

Or disobey, Flattery thought. He said: "How *is* it the computer seems to function on information demand, but not for AAT translation?"

"That could mean only one band to debug," Prudence said. "If it does . . ." She broke off, staring at Bickel, who suddenly seemed in agony.

Bickel had his eyes closed. Perspiration beaded his forehead. The circuitry was as clear in his mind as though projected there from outside himself. He had never completely disconnected the Ox from the AAT system which they had used for the Ox's interpretive routines.

An empty sensation expanded through his chest as he realized every signal from outside into the AAT had gone through the Ox into the computer—there to be lost, there to mix up the AAT translator loops.

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"You didn't disconnect the plugboard from the Ox," Timberlake whispered.

"But my computer read-out comes through my AAT board," Bickel said. He could hear the desperation in his own voice. "Every program demand I put on the computer went through those same Ox circuits!"

"You were using sub-routines with known addresses," Prudence said.

"Now everything you asked for has been scattered through the entire system and lost," Timberlake said.

"Has it?" Bickel asked. He opened his eyes. There was only one logical way to be certain, of course. It wouldn't do any more damage than already had been done . . . if there *was* damage.

We didn't think of his cutting his off from UMB this way, Flattery thought. *Destroying the translator loops!*

Without the translator system to decode the multi-repetitive laser-burst messages, the umbilicus crew might just as well use hand signals for its messages to and from Moonbase.

Carefully, because he had to be certain the first time, Bickel switched five patches in his AAT board, triple checked them.

"What're you doing?" Timberlake demanded.

"Be quiet," Prudence said, as she recognized what Bickel intended.

"But he's already . . ."

"A diagnostic routine," Bickel said. "We'll use a simulsynchronus B-register search with a repeat on our original test of the Ox circuitry. If harm has already been done, this will just go right through the same channels. It can't do any more harm."

"And the B-register search could tell us where our data went," Timberlake said. "Yeah."

"Are you sure?" Flattery asked.

"The technique is right," Prudence said.

Working quietly, triple checking, Bickel patched together the necessary program. He took a deep breath, sent the first elements of the diagnostic routine through the inputs, setting the balance of the test for off-line operation. He had to keep a constant check on this.

Presently, he began to get DDA output, put it on conditional transfer with print-out at each step in the control sequence.

He felt breathing at his shoulder, looked up to see that Prudence had abandoned her action couch, knelt beside him to stare up at the read-out.

"The data's been shifted, not lost," she whispered.

"That's how it looks," Bickel said.

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"It might as well be lost!" Timberlake barked.

"No," Bickel said. "The computer's fully operative as long as we route everything through the Ox."

"Why didn't the AAT work?" Timberlake demanded.

"Come off that, Tim," Bickel said. "You helped me build that test set-up."

"The incoming messages were going through the AAT circuits twice," Timberlake said. "Sure."

"The bits cancelled themselves out all along the line," Bickel said. "We probably didn't get a fifth of the message."

"It did seem short," Prudence said.

"That message is the only thing we've really lost," Bickel said. "I'll ask for a repeat on . . ."

"Wait!" Flattery said.

"Yes?" Bickel looked at him.

"What do you tell UMB happened to the original message?" Flattery asked. He glanced away from Com-central, met Bickel's gaze. "And what if they *were* telling us to cease and desist?"

"You know something," Timberlake said, "the beginning and end of Hempstead's message didn't seem to be garbled at all."

"Standard call and sign-off," Bickel said. "They could be recognized and translated from the smallest fractional bits."

"But the message load was

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lightest at the beginning," Timberlake said. "And that could be part of the explanation there. You'd get minimum cancellation. We might be able to salvage more of the message . . . especially in the first parts before the load jammed it up."

This is exceedingly cautious for Timberlake, Flattery thought. *Is he coming around to Bickel's viewpoint?*

Bickel found himself moving hesitantly, not knowing why, but unable to escape the logic in Timberlake's argument. He slid out the message print, shuttled it to the replay rack. If only the print had been the first step in the reception, instead of intermediate, he thought. He removed his feedback patches, sent the print directly into the Ox and then into AAT, routed the read-out through the Optical Character Print system and the screen above them.

Hempstead's original call appeared there, and they all looked up at it.

That had *to be accurate,* Bickel thought.

There came that original long delay, then: "CHOOSE BY LOT FROM THE COLONISTS IN HYBERNATION A SUITABLE BRAIN TO REPLACE YOUR ORGANIC MENTAL CORE PERIOD MEDICAL PERSONNEL ARE DIRECTED TO TAKE A HUMAN BRAIN COMMA INSTALL IT AS TEMPORARY ORGANIC MENTAL CORE COMMA AND RETURN SHIP TO BIDGEYBIDGE BIDGEY SOMETIMES WITH THE HIT IT PERIOD PERIOD PERIOD PERIOD PERIOD PERIOD ON THE QUESTION OF DEFINING CONSCIOUSNESS COMMA YOU HAVE THIS DATA SEVERAL TIMES IN YOUR COMPUTER DATA AND YOU CAN REFER THERE PERIOD REFERENCE IS MADE TO DATA ITEM ANINSZERO FOR NERVE BARRIER AND THRESHHOLD DATA YOUR COMPUTER PERIOD BEST DIVE YET PERIOD NEW ORGANIC MENTAL CORE PERIOD MEDICAL PERSONNEL ARE DIRECTED TO ABANDON ALL SUCH REPEATS IN THEIR WASTE OF ORDER PERIOD."

VIII

Flattery had just shifted the Com-central board to Prudence. He looked across at Timberlake, who sat on the edge of his action couch staring at a memo pad of ship paper. The thin paper rustled faintly as Timberlake folded back a page, scribbled something on a clean surface.

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Flattery's duty shift had exhausted him. He felt drained—and at the same time keyed up. Apprehensive. He felt that forces were gathering over which he could have no control.

They had come to no solution of the communication problem. Or of any other. Perhaps, none was possible.

He looked up at the monitor screen and observed it was blank.

For a moment it did not register. He looked over to the console in front of Prudence, saw that the command-circuit key pointed to "on." But the screen remained blank.

That key is on! Flattery told himself.

But why was the screen blank?

As though she read his mind, Prudence said: "John's installed an override on the command circuit. Any idea why?"

"Didn't you see where he was?" Timberlake demanded. "He was in the shop—working on that Ox mess!"

Timberlake unlocked his action couch and in almost the same motion, launched himself at the hatch to the computer maintenance shop. He wrenched at the lock dogs, but they remained immovable.

"He's jammed the lock!" Timberlake said. "If he wrecks our computer . . ."

"You noticed . . . so you may as well watch."

It was Bickel's voice.

They looked up to see a view of the shop in their big screen. Bickel stood with the detritus of the initial Ox installation around him—dangling leads, meters, neuron blocks—all stacked precariously away from the computer wall.

"Bickel, listen to reason," Timberlake said. "You can't just tear into . . ."

"Shut up or I'll turn you off," Bickel said.

He knelt with a substitute neuron block, inserted it between the Ox and the computer wall, began making connections.

"Please, John," Prudence said. "If you'd . . ."

"You're not going to stop him by talking to him," Flattery said.

"Listen to Raj," Bickel said. He slipped another neuron block into place against the wall, made new connections.

"Rhythm," he said. "I went to sleep on it . . . and it woke me up. That and your yakking. Rhythm."

Another substitute neuron block went into place beneath the first two.

"Describe what you're doing," Flattery said, and he motioned for Timberlake to come to his side.

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"Brain-vision anatomy can be reduced to the mathematical description of a scanning process," Bickel said. "It follows that any other brain-function anatomy—including consciousness—should submit to the same approach. I can duplicate the alpha-rhythm cycle for a brain-scanning sweep by setting it up in the time-cycle of these neuron blocks. If I trace each rhythm from a human model and duplicate . . ."

"What's the function of each of these human rhythms?" Flattery demanded.

As he spoke, Flattery scribbled a note on a pad of ship flimsy, pressed it into Timberlake's hand.

Timberlake looked up to the screen, but Bickel still had his back to the video eyes that matched the screen-view.

"We don't know the function for certain, do we?" Flattery said, and he motioned frantically for Timberlake to read the note.

Timberlake turned his attention onto the paper, read: "BACK WAY, AROUND THE HYB TANKS. BICKEL HASN'T JAMMED THE HATCH FROM QUARTERS. TAKE THE OTHER TUBE AND SURPRISE HIM."

Again, Timberlake looked up to the screen.

The Ox was taking on new shape under Bickel's hands—reaching out to the angle of the shop against the computer wall. It began to assume a feeling of topological improbability in Timberlake's eyes—with jutting triangles of plastic, oblongs of neuron couplers, strips of Eng multipliers . . . and the color-coded leads interweaving like a crazy spectrum.

Timberlake felt a hand grab his arm, shake him. He looked at the hand, followed its arm to Flattery's glaring face.

Flattery gestured to the note in Timberlake's other hand.

Again, Timberlake looked at the note, recognizing why he stood rooted to this spot.

Around the hyb tanks?

No.

It would have to be through the hyb tanks.

Flattery must know that.

Timberlake turned his tortured gaze on Flattery, bringing the terror up to full awareness.

Bickel has infected me with his cynical scepticism, Timberlake thought. *I'm afraid of what I'll find in the hyb tanks if I look too close. I'll find the tanks empty, and nothing but leads back into the computer from the tanks. And the computer will be programmed to simulate the presence of hybernating life in those tanks. The whole thing will turn out to be a monstrous hoax.*

I'll discover, I've been life-

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systems engineer to . . . nothing. The thought set him shivering.

I'll use the shot-effect generator again, Bickel thought.

He leaned into the organized clutter of the Ox, clipped a lead onto the temporary input, threaded the lead out and draped it to one side.

The effect and the way to achieve it were still clear in his mind. He had awakened suddenly, not knowing how long he had slept, but feeling refreshed and with this *answer* filling his mind.

He turned to the computer leads, linked the Ox through a buffer that would feed its impulses into a test-memory bank, connected this to one of the new bank of neuron blocks, and put the system on full interlock.

"Will you at least explain what you're doing, John?"

It was Flattery's voice out of the screen.

Bickel glanced back, saw Prudence at the controls, Flattery sitting on the edge of an action couch—no sign of Timberlake. But this screen's eyes didn't expose all of Com-central. It was probable that Timberlake was trying the hatch.

Well, let him, Bickel thought.

"We have only ourselves to use as models for producing this Consciousness Function," Bickel said. "And everybody keeps saying we can't get *into* ourselves the way an engineer should to duplicate the mechanism. But, friend, there's another approach—thoroughly tested and effective."

Prudence said: "Raj?"

Flattery looked at her.

"I'm getting current drive on the auxiliary power supply," she said.

"It's the shop," Flattery said. "John's taken a direct line to prevent us from shutting him off." He looked back at Bickel. "Right?"

"Right," Bickel said. "It shouldn't cause you any trouble. I've isolated the line. Your main board is still functioning." He turned back to the Ox, began tieing in a series of timed neurofibers.

"What's the tested, effective method?" Flattery asked. He looked up at the telltales on the Com-central board, following Timberlake's progress by the heat sensors. Timberlake was out in the second zone now, turning in toward the opposite side of the shielding and the hyb tanks.

Why had Tim been so reluctant to go? Flattery wondered.

Bickel finished a triple connection along the timed fibers, straightened, said: "The system you can't tear apart and examine is called a black box. If we can make a *white* box sufficiently similar and general in *poten-*

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tial to the black box—that is, make it sufficiently complex—then we can force the black box, by its own operation, to transfer its pattern of action to the white box. We cross link them and subject each to identical shot-effect bursts."

"What's your white box?" Flattery asked, his interest and attention caught in spite of his fears. "That thing?" He nodded toward the crazy-block construction of the Ox.

"Hell, no," Bickel said. "This is nowhere near complex enough. But our entire computer system is."

He's gone crazy! Flattery thought. *He can't be suggesting seriously that he'd throw a scrambling shot-effect burst into the computer!*

Again, Flattery glanced up at the telltales. Timberlake was at the edge of the hyb tanks, moving at a maddeningly slow pace.

"Then . . . how does the Ox function in this?" Flattery asked, returning his attention to the screen.

"This is our sorter," Bickel said. "It sorts the rhythms of the system and acts as a crude kind of frontal lobes." He linked two parts of his construction by cross-jacks in a patchboard, said: "There. Now to run a few tests."

"Shouldn't you wait?" Flattery demanded. "Shouldn't we discuss this a bit more? What if you've made a mistake and . . ."

"No mistake," Bickel said.

Flattery looked to the telltales. Timberlake was in the hyb tanks now, but he wasn't moving—just stopped there.

We set our 'organ of analysis' at too high a pitch, Flattery thought. *We should've known it could run wild.*

What was keeping Timberlake?

"Straight line test, first," Bickel said, and closed a key on the computer wall. He stared at the diagnostic-circuit dials above him.

Flattery held his breath, turned slowly to look at the big board in front of Prudence. If Bickel's test loused up the central computer system, it'd show up first on the big board.

The warning flashboard retained its quiet green. The steady ticking of relays through the graph counters and monitors held at an even pace. Everything appeared soothingly ordinary.

"I'm getting individual nerve-net responses on the separate blocks," Bickel said. "Orthogonal nerve-net response in relation to the input."

Flattery kept his attention on the flashboard. If Bickel ruined the computer, the ship was dead. Most of the *Tin Egg*'s automatic systems depended on the com-

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puter's inner lines of communication and supervisory control programs.

"Didn't you hear me?" Bickel demanded. "I'm getting nerve-net response! This thing'll behave like a human nervous system!"

"Raj, he is!"

It was Prudence, and Flattery dropped his gaze to where she was pointing. She had shifted a small corner of her own auxiliary board into a repeater system tied to Bickel's diagnostic-circuits.

"Beta rhythm," she said, pointing to the scope in the center of the board.

Flattery watched the sine-play of the green line on the scope, digesting what Bickel had said, what that scope implied.

Black box-white box.

Perhaps it was possible, theoretically, to use the entire computer as a white box to take the transfer-pattern called consciousness. But there remained many unanswered questions—and one more vital than all the others.

"What do you intend using as a black box?" Flattery asked. "Where'll you get your original pattern?"

"From a conscious human brain," Bickel said. "I'm going to take one of our spare hyb tanks and adapt the electro-encepholographic feedback system as a man-amplifier."

He's utterly mad, Flattery thought. *The shot-effect shock would kill the human subject.*

Bickel looked out of the screen, stared at Flattery—realizing that the psychiatrist-chaplain had seen the possible deadliness of this proposal.

Who will bell the cat? Bickel thought. He swallowed. *Well, if necessary, I will.*

"How would you protect the subject from the shot-effect bursts?" Prudence asked.

"I believe the subject will have to be fully conscious," Bickel said. "Without any medication . . . or narco-inhibitions."

He waited for the explosion from Timberlake. This idea was sure to outrage the conditioning of the life-systems engineer. Where *was* Timberlake?

"Absolutely not!" Flattery exploded. "It'd be murder!"

Prudence looked away from the console, met Bickel's eyes. "Be reasonable, John," she pleaded. "You're already endangering the computer with that . . ."

"The ship's still functioning, isn't it?" Bickel countered.

"But if you throw a shot-effect burst through that . . ." She nodded toward the stacked blocks and interwoven leads of the Ox beside Bickel. ". . . how'll you avoid damage to the computer's core memory?"

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"Core memory's a fixed system and buffered," Bickel said. "I'll keep the Ox's potential below the buffer threshhold. Besides . . ." He shrugged. ". . . we've already put shot-effect bursts through the computer without . . ."

"And scattered information," she snapped.

"We can still find that information if we use the Ox to sort the addresses for us," Bickel said.

Flattery glanced at the sensors in front of Prudence. What was wrong with Timberlake? Was he injured? Unconscious? But the sensors revealed a narrow path of movement from the life-systems engineer . . . all of it within the hyb tank complex, though.

"If I understand you correctly," Prudence said, "you'll have to add nerve-net simulation channels to the Ox until it and the computer are as complex as a human nervous system. As you build it and test it, we become more and more dependent on that jury-rigged Ox monstrosity for our very lives."

"It has to have a full range of sensory apparatus," Bickel said. "There's no other way."

"There must be!" she said. "Where'd you get such a mad idea?"

"From you," Bickel said.

Shock momentarily stilled her tongue, then: "That's impossible!"

"You're a female," Bickel said, "capable of biological reproduction of conscious life. In that method, you have a substrate of molecules that are capable of assuming a large number of forms . . . different forms. Those molecules assume a *particular* form in the presence of a molecule that already has that form." He shrugged. "Black box-white box."

"What about all those lives down in the hyb tanks?" Flattery asked. "Do they have any choice in this . . . game?"

"They already made their choice," Bickel said.

"And while they're helpless, you change the rules," Flattery said.

"That was one of the chances they accepted when they accepted hybernation," Bickel said. "That was their choice."

Flattery abandoned the argument, pushed himself up.

"What're you going to do?" Prudence asked.

"Check on Tim."

"Where *is* Tim?" Bickel asked.

"Down in the hyb tanks," Flattery said, knowing Bickel could get the answer himself — once he consulted the shop's repeaters.

"Deep in the hyb tanks?"

"Of course!"

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"True!" Bickel snapped. "Try to raise him on the command circuit."

She heard the urgency in Bicktel's voice, and immediately whirled to obey.

There was no response from Timberlake.

"You fools!" Bickel said.

Flattery stopped at the tube hatch, glared up at the screen.

"Who let him go down into the deep tanks?" Bickel demanded. "You blind idiots! Don't you know what he's likely to find down there?"

"What do you mean?" Flattery asked.

"This whole damn' ship's nothing but a simulation device," Bickel said. "There'll be nothing down there except a few crew replacements. Those tanks have to be empty!"

He's wrong! Flattery thought. *Or is he?*

The thought staggered Flattery. He saw immediately how that might pull the props out from under Timberlake — a man tuned as fine as the rest of them for a specific function.

"He'd still have the crew systems," Prudence said. She stared across the room at Flattery, feeling the loneliness — The Tin Egg with its programmed peril might contain only a few isolated humans launched into nowhere.

They wouldn't, Flattery thought. *But if they'd prepare me to cheat the rest of the crew . . .* His feet felt rooted to the deck. He swallowed in a dry throat.

But it's impossible! They promised me when I discovered the actual Tau Ceti prints — if we succeeded we could just send back the report capsule and continue as . . . There is no Tau Ceti planet!

"Raj, are you sick?" Prudence asked.

She studied him, seeing the lost, sunken look in his eyes.

"*The Tau Ceti planets are uninhabitable, yes,*" Hempstead had admitted when confronted with the evidence. "*No Eden. But the universe is known to contain billions of inhabitable planets. You realize you can't come back here, of course. The embarrassment to your hosts.*"

"*The biopsy donors were all criminals,*" Flattery had said, springing his other discovery.

"*Brilliant people, but misdirected,*" Hempstead had protested. "*That is one of the reasons you can't come back, but nothing's to stop you from going on to explore and find your own Eden.*"

Remembering the words, Flattery felt how hollow they sounded.

Sham and trickery all the way, he thought. *But why?*

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IX

Timberlake had launched himself down the metalo-plastic communications tube with a desperate haste, knowing he had to move swiftly or become stalled in an unexplainable terror.

At the tube-distribution lock, he sealed the hatch behind him, snatched a robox-monkey from its rack, tuned the sensors to the track imprinted in the tube wall, slammed its wheels onto the guide marks and grabbed the handhold controls.

Again, he encountered that terrifying reluctance to move, and stared up the tube, studying the long, infinity-curve of it visible through the transparent safety locks.

I can't go back, he thought.

With a sudden wrench, he twisted the little robox tow unit's drive to full on, let it jerk him ahead along that curving track.

The wind of his passage was a dim hiss. He was like a loose piston driving down that tube. Locks opened automatically to the robox signal, closed behind him. He slowed for the protective jog through the shielding layer, twisted around through the branching outside the hyb tanks, dove back down along the flat angle that returned through the watershield and stopped in the lock chamber to the tanks.

He racked the robox, stared at the hatch. It was a big yellow oval, its seal warning in heavy blue letters: "THIS HATCH MUST BE CLOSED AND DOGGED BEFORE INNER HATCH WILL OPEN!"

Now that he was faced with it, Timberlake felt a calm submission to fate controlling his muscles. He gripped the hatch dogs, broke the seal, seeing the line of frost inside as the hatch swung open. His suit generators hummed upscale, compensating for the drop in temperature as chill air spilled out of the lock.

Timberlake slipped into the lock, closed and sealed the outer hatch, turned around. A rack of heavy-duty generators hung over the inner hatch with a big warning sign above them: "EXTREME DANGER! DEEP SPACE OR L-T SUIT REQUIRED BEFORE ENTERING THE NEXT LOCK. BE SURE YOU HAVE SPARE GENERATOR IN WORKING CONDITION BEFORE OPENING THIS HATCH."

Timberlake looped the straps of a spare generator over his shoulder, gave the thing's turbine drive a short burst to check it. The generator hummed briefly. He swung the rack of them aside, broke open the next hatch, slipped through and dogged it behind him.

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Now, a smaller hatch greeted him, and lettered on its face: "ADMISSION ONLY TO LIFE-SYSTEMS ENGINEERS OR MEDICAL PERSONNEL. SUIT SECURITY MUST BE MAINTAINED AT ALL TIMES BEYOND THIS POINT. DO NOT OPEN THIS HATCH UNTIL YOU HAVE ADJUSTED YOUR SUIT FOR THE EXTREME LOW OF HYBERNATION TEMPERATURES."

Timberlake coupled the auxiliary generator to his suit, checked both generators, adjusted them for temperature-security override. The remembered routine occupied his awareness, keeping his mind off the space beyond that hatch. Suit seals slithered under his gloved fingers as he secured them. He dropped the non-fog viewplate over his faceplate, ran a check tape along the seals.

The moment of final decision had come.

Timberlake forced himself to act slowly and calmly. More than his own life depended on what he did now, he told himself. Stray heat inside there could play havoc with helpless lives. He passed his suit's baffles in front of a heat sensor, studied the gauge.

Zero.

His gloved hands went to the dogs of the inner hatch, broke the seal. The hatch popped slightly, indicating a small difference in pressure — nothing abnormal. He stepped through into the glittering dry chill of the first bank of hyb tanks. This was where Prudence had been. He saw her empty tank on his left, its leads dangling, the cushioned carrier still open inside.

Everything around him was revealed in harsh blue cold-light. He studied the chamber.

It was like a giant barrel — an open space in the center surrounded by the smaller barrels that were the individual hybernation tanks. A grid-floored catwalk led down the open center with short ladders and handholds branching up to the separate tanks.

Timberlake kicked off down the length of the tank in three low-grav jumps, caught a handhold beside the breaker lock that separated this section from the next one.

He looked back. *No . . . they weren't little barrels,* he thought. The individual tanks stretched away from him — all around — like so many sections of gray culvert pipe waiting to be assembled into something useful . . . like a drain.

There was no point examining the tanks in here, he knew. This

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was number-one section: high priority crew replacements. If there was deception, it'd be further along the line — in one of the deeper sections.

Timberlake opened the safety value at the breaker lock, swung open the hatch, let himself through, reset the mechanism to isolate the section in the event of partial damage.

He looked around the new section. It was the twin of the other one except for the absence of a raided tank.

Timberlake swallowed. His cheeks felt damp and cold. A place between his shoulder blades itched.

Quite abruptly, he found himself remembering Professor Aldiss Warren, the lecturer in biophysics back at UMB. He was a goat-bearded old man with a senile sounding voice and a mind like a scimitar.

Why do I think of old Warren — now? Timberlake wondered.

As though the question released a hidden awareness, he recalled the old man diverging from a seminar discussion to talk about moral strength.

"You wish to test moral strength?" he'd asked. "Simple. Construct a med-computer with a public callbox attachment. Set it that anyone submitting to the computer's probes can find out to within a day or so when he'll die . . . of natural causes, of course. If you wish to call old age natural. Then you step back and see who uses the thing."

Someone — a feminine student in the back of the class — had asked: "Wouldn't it take a kind of courage *not* to use this computer?"

"Pah!" old Warren had exploded.

Another student had said: "Hypothetical questions like this always bore the hell out of me."

"Sure," old Warren had said. "You young toughs haven't faced the fact we could build such a med-computer — right now, today. We've had the ability to build it for more than thirty years. It wouldn't even be very costly — as such things go. But we don't build it."

Timberlake held himself still and silent in the hyb tank, realizing why he had remembered that incident. Coming into this cold-lighted tank was like using old Warren's hypothetical death predictor.

Bickel infected me with the certainty that this ship is not what it seems to be, Timberlake thought. *He took over command, pushed me aside. The only reason for being here that was left me* — He looked up and around the tank — *was in here. If this*

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is taken from me then I'm truly useless except as a kind of computer-shop flunky for Bickel.

Yes, Bickel. Right away, Bickel. Is there anything else, Bickel?

Presently, he launched himself up to an individual tank hanging low on the left curve, center. The tank was like all the others racked in curving rows around it. He activated the inner cold light, caught a handhold and bent close to the tank's inspection port.

The light flickered, glowed. It illuminated the metered master tubes dropping from the tank's other side, a color-coded sheaf of spaghetti that trailed down left and right to the figure under the light.

A man's craggy profile lay there, waxy skin and faint black beard. He was like a mannequin figure — and Timberlake thought immediately of elaborate human-size dolls racked here to maintain the pretense.

Timberlake studied the life-systems telltales above the spaghetti sheaf. They registered a faint flame of life within the tank. Timberlake made a tiny adjustment in the oxygen meter, caught the immediate feedback surge on the tank's electroencephalographic coupling.

The oxygen meter reset itself.

This, then, was a hybernating man. That feedback reaction with its elaborate encephalographic play, could not be programmed for the unexpected. The oxygen shift at this moment in time obviously could not have been anticipated. A human homeostate had detected it, though, and reacted correctly.

Timberlake dropped down to the gridded catwalk, checked a tank opposite, and another farther down the line.

He went through them at random, pausing only to check that each held a living human.

One of them he recognized — black hair, olive skin with its waxy undertone, chiseled features — Frank Lipera, a fellow student in human engineering.

Presently, Timberlake went on to the next section . . . and the next. He found he recognized many of the occupants. This filled him with a feeling of loneliness. He felt that he might be the keeper of a museum, guarding old relics for a brief human lifespan, sequestering beneath these blue cold-lights a share of man's culture and knowledge.

He came at last to a corner of section seven, another recognizable face from his UMB past—blond and germanic, pale wax skin. Timberlake read the name etched above the inspection port: "PEABODY, Alan—K-7a."

Yes, it was Al Peabody, Tim-

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berlake agreed. Yet, in a way it wasn't Al . . . too. It was as though the companion of Timberlake's gym classes, his opponent in handball and moon tennis, had gone away somewhere to wait.

But Peabody, Alan — K-7a proved to be a visable human within individual homeostatic reactions. He could be awakened to speak and act and think. He could be wakened to consciousness.

And consciousness is a thing beyond speaking and acting and thinking, Timberlake thought.

He loosened the handhold, dropped lightly back to the catwalk, feeling no particular need to check further. He knew with an inner certainty that all the tanks held hybernating humans. Bickel might be correct about the *Tin Egg* being an elaborate simulation, but in here the simulation went too far in the direction of reality for it to be anything other than what it seemed. The hyb tanks had not been larded with obvious deception.

I was supposed to come through here, surprise Bickel and stop him, Timberlake thought. *Stop him from what?*

Some tiny, unregistered perception worked on the edge of Timberlake's awareness, assuring him that whatever Bickel was doing right now in the shop held no immediate danger to these helpless sleepers.

Whatever Bickel's doing, he must be doing it right now, Timberlake thought. *I've been gone . . . almost on hour.*

He looked up at the rows of tanks.

Yet, every tank I checked was functioning at peak efficiency, as though the entire system were tuned to a critical optimum.

Timberlake nodded to himself.

You might almost think a mental core still rode monitor on the ship's vital parts.

He felt that he could almost hear the tremendously slowed oscillations of life around him.

The spot between his shoulderblade had ceased to itch, but he felt painfully tired now, slightly dizzy, his body dragging at his muscles.

It occurred to Timberlake then that they could be going at the problem of reproducing consciousness too literally. *Will we have to install mechanisms that permit the Ox to grow tired?* he wondered. *We're too literal . . . like peasants asking the genie for three wishes.*

Maybe we won't like our wishes if we get them.

God, I'm tired.

Something moved near the far bulkhead—a space-suited figure.

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For one instant of unreality, Timberlake thought that one of his hybernating charges had revived itself. Then, the moving figure came full into the glare of the cold-light and Timberlake recognized Flattery's features behind the anti-fog plate of the helmet bubble.

"Tim!" Flattery called.

His voice boomed from the suit amplifiers, echoed with a metallic ringing through the cold air of the tank.

"Something wrong with your suit receiver?" Flattery asked, stopping in front of Timberlake.

Timberlake looked down at the command set near his chin, saw that its circuit indicator light was dark.

I left it off, Timberlake thought. *Never even thought of turning it on. Why'd I do that?*

Flattery studied Timberlake carefully. The man's motions when first seen across the tank had indicated nothing seriously wrong. He moved. He seemed aware of his surroundings.

"You feel all right, Tim?" Flattery asked.

"Sure. Sure . . . I feel all right."

Like three wishes, Timberlake thought. *Like the three S's of our school joke: Security, Sleep and Sex.*

Something touched his shoulder, and he realized he had heard the inner bulkhead open. He looked around to see Bickel standing there.

"You feel up to some work, you two?" Bickel asked. "I need your help."

X

The three men came to the inner locks and the back passage beneath the primary computer installation and up into the shop. They slipped through, sealed the hatch.

Bickel threw back his helmet.

Flattery and Timberlake did the same. Bickel already was loosening his glove seals.

Timberlake stared at Flattery, watching the way the man studied the jutting boxes and angles, the interwoven leads of the Ox.

"Infinite counting net?" Flattery asked.

"Why not?" Bickel asked. "You have it. You can count beyond the number of your own total nerve supply. The Ox has to do the same."

"You know the danger," Flattery said.

"Some of the danger," Bickel admitted.

"This ship could be one gigantic sensory surface," Flattery said. "It's receptors could achieve combinations unknown to us, could contact energy sources unknown to us."

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"Is that one of the theories?" Bickel asked.

Flattery took a step closer to the Ox construction.

"Before you do anything destructive," Bickel said, and he nodded toward the patterned confusion clinging to the computer wall with its wire tentacles, "you'd better know I'm already getting conscious-type reactions on a low scale—the system itself activating various sensors. It's like an animal blinking its eyes—a heat sensor here, audio there . . ."

"That could be a random dislodge pattern due to the shot-effect bursts," Flattery said.

"Not when nerve-net activity accompanies each reaction," Bickel said.

Flattery digested this, feeling his conditioned fear-alertness—the reaction for which he was but a trigger—come to full amplitude. His mind focused on the two red keys and the self-destruction program they would ignite through the computer-links of the ship.

"Tim, how tired are you?" Bickel asked.

Timberlake looked at Bickel. *How tired am I?* Minutes ago, he had been shot through with fatigue. Now . . . something had keyed him up, filled him with a feeling of elation.

Conscious-type reactions!

"I'm ready for another full shift," Timberlake said.

"This thing's too simple yet to even approach full consciousness," Bickel said. "Most of the ship's sensors bypass the Ox circuits. Robox controls aren't connected and it has no . . ."

"Just a minute!" Flattery snapped.

They turned, caught by the anger in Flattery's voice.

"You admit this goal-seeking mechanism may operate entirely outside your control," Flattery said, "and you're still willing to give it eyes—and muscles?"

"Raj, before we're finished, this thing has to have complete control of the ship."

"To get us across the big-empty and safely to Tau Ceti," Flattery said. "You're assuming that's the ship-computer's basic program?"

"I assume nothing," Bickel said. "I checked. That's the basic program."

To Tau Ceti! Flattery thought. He felt like both laughing and crying. He didn't know whether to tell them the truth—the fools! But . . . no; that would render them less efficient. Best to play the charade out to its silly conclusion!

"Can you prevent damage to the computer core?" he asked.

"It'll be buffered forty ways

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from Sunday," Bickel said. "I've already started the buffering."

"What if it develops that it's fatal to go to Tau Ceti?" Flattery asked.

Why is he quibbling? Bickel wondered. *Surely, he knows the answer to that.*

"A simple binary decision solves that," Bickel said. "We give it a turn-back alternative."

"Ahhhhh," Flattery said. "The best of all possible moves, eh? But we're in the Queen's croquet game. You said it yourself. What if the Queen of Hearts changes the rules? We've no Alice in this wonderland to haul us back."

A deliberately poor move somewhere along the line changing the theoretical structure of the game, Bickel thought. *That's an indicated possibility.*

He shrugged: "Then we get sent to the headsman."

Timberlake cleared his throat. He felt an overpowering curiosity to inspect and test what Bickel had built—to trace out the circuitry and try to find why it wasn't upsetting gross computer function.

"If we run into the Queen of Hearts problem," Timberlake said, "the ship stands a better chance if it's controlled by an imaginative, conscious intelligence."

"*Our* kind of consciousness?" Flattery asked.

There's what's eating him, Bickel thought. *He's obviously the one charged with seeing we don't loose a killer machine in the universe. Homeostasis for a race can be different from the balance needed to keep an individual alive. But we're isolated out here—an entire race in a test tube.*

"We're talking about creating a machine with a specific quality," Flattery said. "It has to operate itself from the inside, by probability, and can't be controlled by determinations from the outside. We can't determine everything it's going to do." He raised a hand as Bickel started to speak. "But we can determine some of its emotions. What if it actually cares about us? What if it admires and loves us?"

Bickel stared at him. That was a beautiful idea, an audacious idea—completely in keeping with Flattery's function as chaplain, colored by his psychiatric training, and protective of the race as a whole.

"Think of consciousness as a behavior pattern," Flattery said. "What has contributed to development of this pattern? If we go back . . ."

His voice was drowned in the klaxon blare of the emergency warning.

They all felt the ship lurch

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and the immediate weightlessness as the caged failsafe switch disconnected the grav system.

Bickel drifted toward the forward end of the shop, caught a stanchion, swung himself around and kicked off toward the Comcentral hatch.

He went quickly through the hatch in the same fluid motion of opening it, slammed and dogged it, hurled himself toward his couch. He locked in, swept his gaze across his repeaters.

Prudence was making only minimal corrections on the big console, studying the drain gauges.

Bickel saw that the computer was drawing almost eighty per cent of its power-demand capacity, began checking for fire and shorts. He heard cocoon triggers snap as Flattery and Timberlake took their places in their couches.

"Computer drain," Timberlake said.

"Radiation bleed-off in Stores Four," Prudence said, her voice hoarse. "Steady rise in temperature back of the second hull bulkheads . . . no; it's beginning to level off."

She programmed for a hull-security check, watched the sensor telltales.

Bickel looking over her shoulder at the big board, saw the implications of the flickering lights as soon as she did, said: "We've lost a section of outer shielding."

"And hull," she said.

Bickel lay back, keyed the repeater screen for monitoring the sensors, began an analysis outward into the indicated area, said: "You watch the board; I'll make the check."

Images flickered on and out in the little screen at the corner of his board as he keyed it to new sensors farther and farther out. Halfway through Stores Four, he was staring into the star-sequinned darkness of open space. The sensor eyes revealed foam coagulant flowing into a wide, oval hole from the hull-security automatics.

Out of the corner of his eye, Bickel saw Flattery running a micro-survey along the edge of the break in the hull. "It's as though it were sliced off with a knife," he said. "Smooth and even."

"Meteorite?" Timberlake asked. He looked up from a check of the hyb tanks.

"There's no fusing at the edge or evidence of friction heat," Flattery said. He took his hands off his board, thinking of the island in Puget Sound—the wild destruction in the surrounding countryside.

Rogue consciousness.

Has it started already? he asked himself.

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"What could make that cut through the outer shielding and hull without heating them at least to half-sun?" Bickel asked.

No one answered.

Bickel looked at Flattery, seeing the white, drawn look to the man's mouth, thought: *He knows!*

"Raj," Bickel said, "what could do that?"

Flattery shook his head.

Bickel took a reading on the laser-pulsed timelog off his own repeaters, extracted a position assessment, noted transmission-delay time to UMB, swung his transmitter to his side and keyed it for AAT coding.

"What're you doing?" Flattery asked.

"*This* we'd better report," Bickel said. He began cutting the tape.

"How about some gravity?" Timberlake asked. He looked at Prudence.

"System reads functional," she said. "I'll try it." She thumbed the reset.

The ship's normal quarter gravity pulled at them.

Timberlake unlocked his cocoon, stepped out to the deck.

"Where're you going?" Prudence asked.

"I'm going out and have a look," Timberlake said. "Some force takes a slice off our hull without crisping the area or spreading a shatter pattern? There is no such force. This I've got to see."

"Stay right where you are," Bickel said. "There could be loose cargo out there . . . anything."

Timberlake thought of lovely Maida crushed by runaway cargo, swallowed.

"What's to prevent it slicing us neatly right down the middle —next time?" Prudence asked.

"What's our speed, Prue?" Timberlake asked.

"C over one five two seven," she said, "and holding."

"Did . . . whatever it was slow us at all?" Flattery asked.

Prudence ran the back check on the comparison log, said: "No."

Timberlake took a deep, quavering breath, said: "A virtually zero impact phenomenon with a force effect of . . . what? Infinity?" He shook his head. "There's no kinetic equivalent."

Bickel tripped the transmission switch, waited for the interlock, looked at Timberlake. "Did the universe begin with Gamow's 'big bang' or are we in the middle of Hoyle's continuous creation? What if they're both . . ."

"That's just a mathematical game," Prudence said. "Oh, I know: the union of infinite mass and finite sources can be ac-

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complished by postulating zero impact-infinite force, but it's still just a mathematical game, a cancelling-out exercise. It doesn't *prove* anything."

"It proves the original power of Genesis," Flattery whispered.

"Oh, Raj, you're at it again," Prudence said, "trying to twist mathematics to prove the existence of God."

"God took a swipe at us?" Timberlake asked. "Is that what you're saying, Raj?"

"You both know better than to take that attitude—under these circumstances," Flattery said. And he thought: *When they get that message at UMB, they'll know we've achieved the stage of rogue consciousness. There's no other answer.*

Prudence stared up at the big console, wondering what had happened to the ship.

The damage had been caused by something outside the ship. There had been a faint lurch transmitted through the *Tin Egg,* but that had come afterward. The damage telltales already had been flaring out red and yellow. The lurch had been associated with power drain and a shift of switching equipment to the necessities of automatic damage control.

Zero impact-infinite force.

Something outside the ship had sliced through them like a razor through soft butter. No—infinitely sharper.

Something from outside.

She put a hand to her cheek. That pointed to something beyond the dangers programmed into the ship.

They'd encountered something out of the wide, blank unknown. She thought suddenly of sea monsters painted on ancient charts of the earth, of twelve-legged dragons and humanoid figures with fanged mouths in their chests.

She restored a degree of calmness by reminding herself that all these monsters had faded before humanity's monkey-like inquisitiveness.

Still—something had struck the *Tin Egg.*

She ran another visual survey of her board, noting that automatic damage control had almost completely flooded out Stores Four with foam seal. Section doors were sealed off for two layers around the damage area.

Whatever had hit them, it had taken only a thin slice . . . this time.

"Time for my watch," Flattery said. "Prue?"

Flattery's words made her aware in a sudden rush of acceptance how tired she was. Her back ached and the muscles of her forearms trembled. She could

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remember only once before having been this tired—after almost five hours of surgery.

"On the count," she said.

They shifted the big board, and Flattery scanned the instruments, preparing to fit himself into the *mood* of the ship.

And the Tin Egg does have her moods, Flattery thought.

Sometimes, he felt as though the ship carried ghosts within it—of the sixteen men killed by accident during the construction on the moon, of umbilicus crewmembers killed by the ship's programmed savagery—or perhaps of the OMCs sacrificed on this altar.

Did those bodiless brains have souls? Flattery wondered. *For that matter—if we breathe consciousness into this machinery, will our creation have a soul?*

"Have the automatics finished sealing the break?" Bickel asked.

"All sealed," Flattery said. And he wondered: *When will the rogue consciousness hit us again?*

"What was in Stores Four?" Prudence asked. "What'd we lose?"

"Food concentrates," Bickel said. "First thing I checked."

His tone said: *"You had the watch; you should've checked."*

"Raj, do you want us to start sharing the watch and watch?" Timberlake asked. "After I've had some rest . . ."

"After you've had some rest, you can help me in the shop," Bickel said.

"We've just decided," Prudence said, "just like that—" she snapped her fingers—"that you can go on stirring around in the computer like a wild man?"

"For Christ's sake!" Bickel said. "Haven't any of you realized yet we were supposed to use the computer as the basic element of attack?"

Bickel stared around at them, Flattery busy on the board, Timberlake half asleep sitting up at his couch, Prudence glaring at him from her couch.

"That's no ordinary computer," Bickel said. "It has elements we don't even suspect. It was hooked up with an Organic Mental Core for almost six years during the construction and programming of the ship. It has buffers and leads and cross ties that its own designers may not even know about!"

"Are you suggesting it's already conscious?" Prudence asked.

"No, I'm not suggesting it's already conscious. I'm suggesting that we've come a long way using that computer and our Ox frontal-lobe simulator. We've come farther than the UMB project did in twenty years! And we should go on with this. We're

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cutting a straight line through all the . . ."

"There are no straight lines in nature," Flattery said.

Bickel sighed. *What now?* he wondered.

"If you've got something to say, spit it out," Bickel said.

"Consciousness is a type of behavior," Flattery said. "Agreed?"

"Agreed."

"But the roots of our behavior are buried so far away in the past we can't get at them directly."

"Emotion again, eh?" Bickel demanded.

"No," Flattery said.

"Instinct," Prudence said.

Flattery nodded. "The kind of genetic imprint that tells a chicken how to crack out of its shell."

"Emotions or instinct, what's the difference?" Bickel asked. "Emotions are produced by instinct. Are you still saying we can't bring the Ox to consciousness unless it has instincts cum emotions?"

"You know what I'm saying," Flattery said.

"It has to love us," Bickel said. He chewed at his upper lip, caught again by the beautiful simplicity of the suggestion. Flattery was right, of course. Here was a loose rein that could satisfy the failsafe requirements. It controlled without galling.

"It has to have an autonomic

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system of emotional reactions," Flattery said. "The system has to respond with a set of physical effects of which the Ox is . . . aware. Something like the characteristic human muscular reactions and voice tones, the things we use to respond to emotions."

Emotion, Bickel thought. *The characteristic that gives us our sense of person, the thing that summates personal judgments. A process in capsule form that can occur out of sequence.*

Here was a break with all machine concepts of Time—Emotion as Process, an audacious way of looking at Time.

"There's nothing of ourselves about which we can be objective," Bickel said, "except our own physical responses. Remember? It's what Dr. Ellers was always saying."

Flattery thought back to Ellers, UMB's chief of psych. "*Bickel is 'purpose,' the force that will give direction to your search,*" Ellers had said. "*You have substitutes, of courage. Accidents do happen. But you've nothing honed as fine as Bickel. He's a creative discoverer.*"

Emotion, Bickel thought. *How do we symbolize it and program for it? What does the body do? We're inside, in direct contact with whatever the body's doing. That's the only thing we can really be objective about. What does the body . . .*

"It has to have a completely interfunctioning body," Bickel said, seeing the whole problem and answer as an abrupt revelation. "It has to have a body that's gone through trauma and crises." He stared at Flattery. "Guilt, too, Raj. It has to have guilt."

"Guilt?" Flattery asked, and wondered why the suggestion made him feel angry and half fearful. He started to object, grew conscious of a rhythmic rasping. He thought at first it was a malfunctioning alarm, realized then it was Timberlake. The life-systems engineer had reclasped himself in his action couch cocoon. He was asleep—snoring.

"Guilt," Bickel said, holding his attention on Flattery. "You want it to love us? Okay. Love's a kind of need, eh? It'll have emotions, but that means an unlimited spectrum of emotions, Raj. The spectrum includes fear."

Guilt and fear, Prudence thought. *Raj will have to face it. His training won't permit him to deny this.* She looked at Bickel, seeing the filmed-over, withdrawn look in his eyes.

"Pleasure and pain," Bickel muttered. He focused on Prudence, the sleeping Timberlake,

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on Flattery—each in turn. *Did they see that the Ox had to be able to reproduce itself, too?*

Prudence felt her pulse quickening, tore her attention away from Bickel. She put a hand to her temple, checked the pulse there, related this to her quickened breathing, to body temperature, to hungers, to stage of fatigue and awareness. The serotonin/adrenalin she'd been fed in hyb was giving her an acute awareness of her bodily functions, and that awareness told her she needed chemical readjustment.

"Well, Raj?" Bickel said.

I must compose myself, Flattery thought, turning back onto his couch. *I must appear natural and calm.* He kept his eyes away from the false panel on his repeater board. Bickel was growing exceedingly alert to the tiniest clues. Flattery marked the quiet green of the flashboard, the ticking of relays through the graph counters. Everything of the ship felt soothing and ordinary—all systems functioning.

Yet, deep inside himself, Flattery felt knotted up, like an animal poised at the sound of the hunter.

Bickel felt elation, a breakthrough in some inner factor that had resisted him. The ship—its living organisms, its problems—all were like marionettes and marionette toys. The way out was so clear to him. He'd only hinted at it before. So clear. He could see the necessary schematics stacked in his mind, like transparencies piled one on another.

Four dimensional construction, he reminded himself. ***We have to construct a net in depth that contains complex world-line tracks. It has to absorb non-synchronous transmissions. It has to abstract discrete patterns out of the impulse oversend. The important thing is structure—not the material. The important thing is topology. That's the key to the whole damn' problem!***

"Prue, get us some food and coffee," Bickel said. He glanced at the chronometer beside the Com-central board, looked at Timberlake. Let him sleep.

Thinking within this framework, Bickel saw, put him on a threshhold. A certain pressure here, a certain application of energy there, and he knew he would be projected into a consciousness that he had never before experienced.

The realization inspired fear and awe at the same time it lured him. He turned to Flattery.

"Raj," he said. "We're not conscious."

"What? Huh?" It was Timberlake rousing out of his sleep, rubbing his eyes, staring straight out at Bickel.

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"We're not awake," Bickel said.

XI

"*We're not awake.*" During Flattery's watch, the words haunted him.

Timberlake had muttered something about, "Damn' joker!" and gone off to finish his sleep in quarters.

But Flattery, dividing his attention between the console and the overhead screen that showed the shop with Prudence and Bickel at work there, felt the ship assume a curious identity in his mind.

Flattery felt as though he and the other three crewmembers were merely cells of a larger organism—that the telltales, the dials and gauges and sensors, the omnipresent visual intercom—that all these were senses and nerves and organs of something apart from himself.

"*We are not awake.*"

We keep skirting that thought, Flattery reflected.

Bickel's voice talking to Prudence in the shop—"Here's the main trunk to handle negative feedback. Follow the color code and tie it in across there. Here's the damper circuit; We have to watch we don't introduce reverberating cycles into the random neural paths."

And Prudence, talking half to herself: "The human skull encloses about fifteen thousand million neurons. I've extrapolated from our building blocks and the computer. We're going to wind up with more than twice that number in this . . . beast."

Their voices were like echoes in Flattery's mind. He thought of the total ship, the great machine whose continued life required a certain optimum organization—an *ordering* process. That involved entropy, certainly, because the system that was a total ship tended to settle into a uniform distribution of its energies.

As far as the ship is concerned, order is more natural than chaos, Flattery thought. *But we're playing the ship as though all its parts were an orchestra and Bickel the director. Bickel alone has the score to achieve the music we want.*

Consciousness.

The identity that was the ship —their *Tin Egg*—it lacked a certain integrating ability at the moment. Instead of an efficient self-regulating force, the ship was making do with the inadequate feedback system represented by four humans loosely connected to its 'nervous system.'

That was one way of looking at it.

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But there was a point in the ship's future where damage passed beyond their ability to recover. The humans were failing to make the ship the living, dynamic and interacting system it was designed to be.

Flattery felt then a deep bitterness toward the society that had sent his frail cargo into nowhere. He knew the reasons, but reasons had never prevented bitterness.

"*Think of society as a human construction, a very sophisticated defense mechanism,*" Hempstead and his cohorts had said. "*Society's restrictions get bred into the cells themselves by a process of selection. And these restrictions become part of the self-regulating feedback in society's governing system. There's a serious question whether humans actually can break out of their self-regulated pattern. It takes audacious methods, indeed, to explore beyond that pattern.*"

The law was stated, Flattery knew, thusly: "*Individual human experience is not the overriding control factor in human behavior. The cellular social pattern dominates.*"

Flattery deliberately rapped his knuckles against the edge of his action couch to shock himself out of his reverie. He focused on the console, saw he had the usual temperature adjustments to make. The automatics could never quite hold the line.

Bickel: "Watch those lengths in the time-delay circuits. You'll confuse the Ox's psychological present."

Prudence: "Its what?"

Bickel: "Its psychological present—its 'specious present'—what you experience in any given instant; that short interval you call *now*. Professor Ferrel—remember old Prof Ferrel-barrel?"

Prudence: "Who could forget Hempstead's son-in-law?"

Bickel: "Yeah, but he wasn't stupid. We were on the satellite tracker once—him on his side of the sterile wall and me on ours. And he said: 'Look at that thing move!' It was a shuttle ship coming in from earth. And he said: 'You know for a fact it's changing position fast as hell. But you seem to see all those position changes right now—in the present. No sharp edges; just a flow. That's the "specious present," boy. Don't you ever forget it.' And I never did."

Prudence: "Will the . . . Ox really experience time?"

Bickel: "It has to. Our time-delay circuits have to give it a way of internal measurement. It has to feel its own time. Otherwise, it'll be a big package of confusion."

Flattery looked up into the screen, saw Bickel hook an oscil-

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loscope to the Ox, run a pulse check.

Prudence: "Aren't you likely to overload the computer, bog it down?"

Bickel: "For Chrissakes, woman! You personally receive all kinds of information constantly. Doesn't your own system sort through all that information, queue it up, program it and evaluate the data?"

Prudence: "But the *Tin Egg*'s very existence depends on the computer. If we blunder—"

Bickel: "There's no other way. You should've realized that the instant you saw this whole ship was a set piece."

Prudence (angrily): "What do you mean? Why?"

Bickel: "Because the computer's the only place where that amount of information can be stored. You see, woman, we don't have time to train a completely uneducated infant."

Before she could answer, the transmission horn blared its warning.

The AAT stood on manual bypass to keep its circuits from interfering with the work in the shop. The horn was a trigger that fired both Bickel and Flattery into action. Bickel threw the action switch in the shop. Flattery slapped the AAT master control switch on his console, realizing with a sense of detachment that the UMB message would pour through the Ox's circuits before being displayed for them.

Bickel swept his gaze across the repeater telltales in the shop, watched the needles kick over and come to rest in the normal range. There came the characteristic sharp AAT hum, felt now in the shop because the Ox was part of the circuitry. The sound raised a tingling sensation along Bickel's sides and arms.

The gauges registered the usual AAT pause. The multiple bursts of the message were being sorted, compared, translated and fed into the output net.

Bickel glanced at the screen, saw that Flattery had the system on audio.

Morgan Hempstead's voice began rolling from the vocoders: "THIS IS PROJECT CALLING UMB SHIP EARTHLING PERIOD THIS IS PROJECT CALLING PERIOD WE ARE UNABLE GIVE EXACT DETERMINATION THE FORCE THAT DAMAGED SHIP PERIOD SUGGEST ERROR IN TRANSMISSION OR INSUFFICIENT DATA PERIOD POSSIBILITY OF ENCOUNTER WITH NEUTRINO FIELD OF THEORETICAL TYPE A HYPHEN G SUGGESTED BY ONE ANALYSIS PERIOD WHY HAVE YOU

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FAILED TO ACKNOWLEDGE OUR DIRECTIVE ON RETURN PROCEDURE QUESTION MARK"

Bickel watched his gauges. The message was coming in with remarkable clarity, no garbling at all apparent now that it was routed through the Ox's circuits.

There came the distinct sound of Hempstead clearing his throat.

It gave Prudence a peculiar feeling to hear this ordinary sound—a man clearing his throat. The inconsequential thing had been transmitted millions of miles to no effect other than to inform them Hempstead had been troubled by a bit of phlegm.

Again, Hempstead's voice rolled from the vocoders: "UMB IS BEING SUBJECTED TO HEAVY POLITICAL PRESSURES AS REGARDS ABORT ORDER PERIOD YOU WILL ACKNOWLEDGE THIS TRANSMISSION IMMEDIATELY PERIOD SHIP IS TO BE RETURNED TO ORBIT AROUND UMB WHILE DISPOSITION IS MADE OF YOURSELVES AND CARGO PERIOD"

"That's an awful word—disposition," Prudence said. She glanced at Bickel. He seemed to be taking it calmly.

Flattery could feel the heavy beating of his heart, wondered if the next few words would bring that deadly "kill ship" code signal from Hempstead.

Bickel stared at the vocoder with a puzzled frown. How clear Hempstead's voice sounded—even to the throat-clearing which the AAT should have filtered from the message. He shifted his attention to the Ox's surrealistic growth on the computer wall.

Again, Hempstead's voice intruded: "EXPECT THIS TRANSMISSION A MORE COMPLETE ANALYSIS YOUR DAMAGE PERIOD NATURE AND EXTENT OF DAMAGE OF PARAMOUNT IMPORTANCE PERIOD ACKNOWLEDGE AT ONCE PERIOD PROJECT OVER AND OUT PERIOD"

Bickel kept his voice low, casual, said: "Prue, how'd old Big Daddy sound to you?"

"Worried," Prudence said. And she wondered why Bickel with his inhibitions against return could take this so calmly.

"If you wanted to convey the emotions in some one's message, how would you do it, Prue?" Bickel said.

She looked at him, puzzled. "I'd say what the emotion was or imitate the tone of the original. Why?"

"The AAT isn't supposed to be able to do that," Bickel said. He looked up, meeting Flattery's eyes in the screen. "Don't

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acknowledge that transmission, Raj."

Flattery nodded.

"You mean the AAT's working better than ever?" Prudence asked uncertainly.

"No," Bickel said. "It's working in a way it shouldn't be able to. The laser-burst message is stripped to bare essentials. The original voice modulations are there, theoretically, and often strong enough to recognize certain mannerisms, but subtleties are supposed to be beyond it. That last message was high fidelity."

"The Ox's circuits make the system more sensitive," she said.

"Maybe," Bickel said.

"Was there nerve-net activity accompanying that?" Flattery asked.

"A fish has nerve-net activity," Bickel said. "Nerve-net activity doesn't mean the thing's conscious."

"But sensitized the way consciousness is," Flattery said. "Showing refined results out of neuro-economy the way consciousness does."

Bickel nodded.

"Selective raising and lowering of threshholds," Flattery said. "Threshhold control."

Again, Bickel nodded.

"What's this?" Prudence asked.

"This thing . . ." Bickel pointed to the Ox. ". . . has just demonstrated threshhold control . . . the way we do when we recognize something." He looked at her. "When you lower your reception threshhold, you spread the spatio-temporal message and project it across an internal 'recognition aura' of your mental comparison system. The message is a spatio-temporal configuration which you superimpose on a recognition region. That recognition region can discriminate quite broadly between 'just right,' which is *Maximum similarity*, and a kind of 'blurring off' you could call '*somewhat alike*.' Threshhold control does the tuning for this kind of comparison."

With precisely controlled motions, Bickel returned to the circuitry he had been working on when the UMB message interrupted him. He picked up a sheaf of fibers, noting the neuron tag on them, slid the sheaf into a micro-manipulator and finished the connection to a multi-jack.

In Com-central, Flattery stretched out his left hand, gripped the stanchion beside his action couch until his knuckles went white.

Who can tell me where my soul might be? he thought.

The words of the 139th Psalm slithered through his mind: "*I*

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will praise thee; for I am fearfully and wonderfully made."

Have we betrayed God by making something fearful and wonderful? he wondered.

"Our Father which art in heaven," he whispered.

But I am in the heavens, he thought. *And the heavens expose me still to spiritual risk!*

The sound of Bickel and Prudence working in the shop was almost a carrier wave for his thoughts.

Faith and knowledge, he thought. And he sensed the eternal clash that had taken his body now as its arena—knowledge thrusting at the boundaries of faith. And he felt the destructive emotions his faith was engineered to contain.

I could end this nonsense, he thought. *But we're all in the same bind and violence betrays us.*

"Religion and psychiatry are but two branches of the healing art." He remembered the words clearly. The lecturer in *Uses of Faith,* the second-year course preparing him for this role. "Religion and psychiatry share the same stem."

Heal thyself, he thought.

Flattery ignored the vital console in front of him, closed his eyes and gripped the stanchion fiercely. "The Lord is my shepherd," he whispered. "I shall not want."

But the words had lost their power over him.

There are no still waters here . . . or green pastures, he thought.

There never had been these things for him—or for any of them out of the axolotl tanks and the UMB's sterile creches. There had only been the valley of the shadow of death.

"DO NOT BROACH THIS HATCH WITHOUT READING AIR PRESSURE IN THE NEXT PASSAGE."

Every morning on his way to classes—eleven years—he had passed through the hatch with that warning.

"NO TRAVEL BEYOND THIS POINT WITHOUT FULL SPACESUIT."

That omnipresent sign had set the boundaries on their untrammeled activity. It still did.

The suit was like another social inhibition setting its own limits of behavior. It restricted your contact with other humans, reduced you to code tappings and depersonalized vuphones where every person became like a dancing doll on an oscilloscope screen.

The omnipresent enemy was the *outside*—that total absence of the things to support life, that emptiness called space. I was evil and they feared it—constantly. A rod and staff might comfort in the presence of space, but what

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you dreamed about was washed air and a womb-like enclosed cell where you could divest yourself of the damnable suit. This was the true source of comfort no matter if it came from the devil himself.

The only table you could count on in the presence of this enemy was a squeezebottle slid from its rack. Oil on the head could only fog a faceplate. You had to crop your hair short and keep down the natural oils with detergent.

"The whole universe is a matter of chemistry and mechanics, of matter and energy," he whispered.

But only God was supposed to have complete control of manipulating the matter and energy.

We aren't gods, Flattery thought. *We're blaspheming by trying to make a machine that thinks of itself by itself. That is why I was set to watch over this mission. We blaspheme by trying to put a soul into a machine. I should go down there now and smash the whole thing!*

"Raj!" It was Bickel's voice booming from the intercom.

Flattery looked up at the screen, his mouth suddenly dry.

"I'm getting independent action on the photosensory loops of the computer's record-and-store circuits," Bickel said. "Prue, check the current drain."

"Normal," she said. "It's no short circuit."

"It . . . isn't conscious," Flattery said, his voice wooden.

"Agreed," Bickel said. But what the hell is it? The computer's programming itself in every . . ." There came a charged moment of silence, then: "Damn!"

"What happened?" Prue demanded.

"It stopped," Bickel said.

"What . . . set it off?" Flattery asked.

"I tied an inhibitor block into one arm of a single nerve-net simulator and sent a test pattern through it. The test evidently set up a resonant pattern that searched right through the Ox and into the computer net via the monitor connections. That's when I started getting the self-programming reaction."

Prudence sighted along her finger, moving it to trace a thick color-coded connection that looped down from the Ox. "The monitor linkage goes only one way into record-and-store," she said. "It's buffered right there."

Bickel pulled the connection she indicated.

"What're you doing?" she asked.

"Disconnecting," he said. "I'm going to get the pattern of the experiment out of the memory

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banks and analyze it before proceeding." Silence.

Flattery stared up at the screen with a feeling of horror.

If I destroy it now, he wondered, *will I be . . . killing . . . someone?*

XII

Routine sensor firings sent telltale lights flickering across the computer wall. The passage of the lights produced a weird shift in the shop's illumination. The curved bulkhead opposite the computer face reflected yellow, then green, now mauve . . . red.

The color shift passed across a chart in Timberlake's hand as he read it and compared the chart's predictions with the readings in front of him.

The overhead screen showed Prudence on Com-central about midway through her watch and Flattery in his action couch.

Strange he wouldn't take off for quarters, Timberlake thought.

Bickel emerged from between the Ox's two branchings just as a wash of green splashed down on him from the wall.

"We're missing something," he muttered.

Timberlake wondered at the fear in Bickel's voice, the way the man's head turned from side to side like a caged animal.

"If this thing takes off on its own, we have no control over it," Bickel said. "Raj is right."

"Raj's golem and monster horror stories!" Timberlake said.

"No," Bickel said. "This thing has new *kinds* of memories. They have only the vaguest relationship to human memories. But memories, Tim—the nerve nets stacked in psycho spaces—they're the patterns that create behavior. What's this thing going to do when we turn it on . . . if we don't give it experiences of the kind the human race has survived?"

"You don't know what the racial trauma are and that's where you're hung up."

The voice was Flattery's, and they looked up to the overhead screen to see him sitting still half-cocooned in his action couch and rubbing sleep from his eyes. Beyond him, Prudence maintained her vigil at the big board as though that were the only thing concerning her.

Bickel suppressed a feeling of irritation with Flattery, said: "You're the psychiatrist. Isn't knowledge of trauma supposed to be one of your tools?"

"You're asking about racial trauma," Flattery said. "We can only guess at racial trauma."

Flattery stared out of the screen at Bickel, thinking: *John's panicky. Why? Because the Ox*

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suddenly started acting on its own?

"We have to bring this thing into being," Bickel said, looking at the Ox. "But we can't be sure what it is. This is the ultimate stranger. It can't be like one of us. And if it's different . . . yet alive and aware of its aliveness . . ."

"So you start casting around in your mind for ways to make it more like us," Flattery said.

Bickel nodded.

"And you think we're the products of our racial and personal trauma?" Flattery asked. "You don't think consciousness is the apparent effect of a receptor?"

"Dammit, Raj!" Bickel snapped. "We're within a short leap of solving this thing! Can't you feel that?"

"But you wonder," Flattery said, "are we making a creature that'll be invulnerable . . . at least invulnerable to us?"

Bickel swallowed.

"You think," Flattery said, "this beast we're creating has no sexual function; it can't possibly be like us. It has no flesh; it can't possibly know what flesh fears and loves. So now you're asking: How do we simulate flesh and sex and the racial sufferings through which humans have blundered? The answer's obvious: We can't do this. We don't know all our own instincts. We can't sort the shadows and reflections out of our history."

"We can sort out some of them," Bickel insisted. "We have an instinct to . . . win . . . to survive for . . ." He wet his lips with his tongue, looked around at the computer wall.

"Perhaps that's only hubris," Flattery said. "Maybe this is just monkey curiosity and we won't be satisfied until we've been creators the way God's a creator. But then it may be too late to turn back."

As though he hadn't heard, Bickel said: "And there's the killer instinct. That one goes right down into the slime where it was kill or be killed. You can see the other side of it all the time in our instinct to play it safe . . . to 'be practical.' "

He has done something secret, Flattery thought. *What has Bickel done? He has done something he's afraid of.*

"And guilt feelings are grafted right onto that killer instinct," Bickel said. "That's the buffer . . . the way we keep the instinct within limits. If we implant . . ."

"Guilt involves sin," Flattery said. "Where do you find in either religion or psychiatry a *need* for sin?"

"Instinct's just a word," Bickel said. "And we're a long way from

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the word's source. Why is it? We can raise fifty generations of chickens from embryo to chick in test tubes. They never see a shell. But the fifty-first generation, raised normally under a hen, still knows to peck its way out."

"Genetic imprint," Flattery said.

"Imprint." Bickel nodded. "Something stamped on us. Stamped hard. Oh, we know. We know these instincts without ever bringing them to consciousness. They're what lower our awareness, make us angry, violent, passionate . . ." Again, he nodded.

What has he done? Flattery asked himself, staring out of the screen. *He's panicky because of it. I have to find out!*

"The Cain and Abel syndrome," Bickel said. "Murder and guilt. It's back there someplace . . . stamped inside us. The cells remember."

They glared at each other, Bickel desperate with indecision, and Flattery's suspicions verging on certainty.

He has given the Ox the means to kill, Flattery thought. His argument and his anger betray it. But kill what? Not one of us, certainly. A colonist in the hyb tanks? No. One of the stock animals! He'd dip his toe into violence first, see if the Ox could really do it.

But he cannot have already made the black box-white box transfer.

Prudence, dividing her attention between the control console and the clash of wills, felt herself shift farther and farther into a state of heightened awareness. She sensed Com-central's minute temperature variations, heard the constant metallic creakings of deck and bulkheads around her, saw Flattery's growing suspicions and Bickel's desperate defensiveness, knew her own heartbeats and tiny variations in her body chemistry.

It was the chemistry that fascinated her: the thought that all through this subtle play of organic and inorganic matter which she called herself, messages of which she was only dimly aware (if at all) were being transmitted and acted upon.

The computer with its enormous library of data culled from millions of minds had offered her a way to explore the issue Bickel had raised, and she could not resist this. *Where and how were the instincts carried?*

While the argument between Flattery and Bickel raged, she had translated the question onto an edge-coded tape, shifted it into the computer console section of her board, tripped the action switch.

This went beyond chemical-

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base sequence, she knew, and into the area where knowledge of protein structure itself was only theoretical code. But if the computer gave her an answer that could be translated into a physical function, she knew she could explore the answer through new experiments on her own body.

"Bickel, what've you done?" Flattery demanded.

Prudence looked up from her console, saw Flattery, his shoulders tensed as though about to leap, staring into the screen tuned to the shop. The screen revealed Bickel and Timberlake, their backs turned, staring at the computer wall and the blocks-and-angles contortion that was the Ox.

The hum of the computer could be felt throughout the shop and Com-central. The play of sensor and telltale lights across the board had reached a glittering tempo.

Prudence put the back of her left hand over her mouth, horrified realization flooding her: *He has routed the whole computer through the Ox!*

"What've you done?" Flattery repeated.

"Nothing!" Bickel said without turning.

Timberlake said: "Shouldn't we . . ."

"Leave it alone!" Bickel snapped.

In a low voice, Prudence said: "I did it. I fed a question into the computer."

"What question?" Bickel demanded. He pointed to a large meter above him. "Look at that current drain! I've never seen anything like it."

"I traced out sixty-eight sequential steps of Fourth order bio-chemical configuration," Prudence said. "I programmed it as a comparator of optical isomers as a first step in trying to detect where and how our instincts are imprinted on us."

"It's gone into the monitor banks," Bickel said, nodding at a new play of lights on the wall. "We're getting multi-track reinforcement . . ."

"Like a man concentrating on a tough problem," Timberlake said. Bickel nodded.

The output beside Prudence began hissing as tape sped from it into the strip viewer.

Bickel whirled. "What're you getting."

She studied the viewer, forcing calmness. "A pyramided answer," she said. "I only asked for the first four probables. It's already into the tenth step! It's the nucleic acids, all right . . . down there with the genetic information. But it's tracing out all the dead ends . . . the molecular weights and . . ."

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"It's talking it over with you," Bickel said. "It's asking your opinion. Cut in on it and eliminate the obvious dead ends as you see them."

Prudence scanned back along the strip viewer, checked off useless sequences. *Hydrogen catalysis . . . obviously not. Too much opportunity for contamination.* She cut into the output tape, began deleting and feeding the tape back into the computer.

Output went suddenly silent, but the play of lights against the computer wall raised to a new frenzy. Power drain showed a new surge with a pulse in it.

"Are you feeding a resonant cycle into the system?" Prudence asked. She was surprised how much effort it took to hold her voice level.

"That pulse is identical to the timing of the Ox's response loops," Bickel said.

As he spoke, the output beside Prudence renewed its chattering. Tape surged into the strip viewer.

Prudence stared at it silently.

"Well, what is it?" Bickel demanded.

The output tape rolled to a stop. In the abrupt hush, Prudence said: "It's linked to acid phosphatase . . . amino acid catalysis."

"Is it . . . conscious?" Flattery whispered.

Bickel looked up at the computer wall where lights were winking out, leaving only that somnolent play of telltales—green . . . mauve . . . gold . . .

"No," Bickel said. "We've merely produced a computer that can program itself, concentrate all its bits of information on a problem . . . hunt for data even if that data comes from outside its banks."

"And that isn't conscious?" Timberlake demanded.

"Not the way we are," Bickel said. "You have to ask it a question before it . . . comes to life."

"Acid phosphatase," Prudence mused. "What do we know about acid phosphatase?"

"Widely distributed in the body," Flattery said. He turned, looked at Prudence as though seeing her for the first time. She would understand, of course—almost at once. He looked up to the screen at Timberlake and Bickel. They might have to have it explained to them. He returned his attention to Prudence. How thin and tired she looked.

Prudence nodded to herself, eyes glazed in thought. "Body chemistry, yes," she said. "Male prostate's rich in acid phosphatase. Males store more of it than females."

Flattery spoke cautiously: "Body tissue requires a minimum level before a person can be awakened."

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She jerked upright, met his gaze, said: "An enzyme involved in the physiology of sex and awakening." She turned away, thinking: *Sex and awakening.*

"Is that what anti-S suppresses?" Bickel asked.

"Not directly," Timberlake said. "A-S works primarily on serum phenolsulfatase discrimination, inhibits transfer and action."

Timberlake, the life-systems specialist, the biophysicist, would see it, too, Flattery thought.

Flattery looked into the screen, seeing Bickel standing there so silent and thoughtful, feeling a sudden pity for the man. Such a simple fact: awakening and sex are tied together.

Prudence, reviewing the experiments on her own body, kept her face turned toward the big control board, studied it without really seeing it. The ship could have gone into wild gyrations at the moment and she would have been seconds responding. As she had looked at Flattery, she had seen what he was thinking as though there were words written on his forehead.

Consciousness linked to reproduction.

There was no doubt of it: both came out of the same genetic well. History had washed them in the same waters, transferring the needs of one to the other.

XIII

Slowly, Bickel turned, looked through the screen at the big laser-pulsed autolog in Comcentral recording the passage of Earth-Time. It recorded eighteen weeks, twenty-one hours and twenty-nine seconds. It clicked over another minute as he watched it.

For most of those pulse-counted minutes, Bickel thought, the *Tin Egg*'s crew had been under the pressures of a ship in peril. The danger was real, no matter its source or intent; he had only to study the report on damage accretion to confirm this. But the pressure on the umbilicus crew had started with the loss of the Organic Mental Cores. The pressure had started when they were no longer shielded by another consciousness.

For the first time, Bickel turned his thoughts onto the concept of consciousness as a shield —a way of protecting its possessor from the shocks of the unknown. It was an "I can do anything!" answer hurled at a universe that threatened you with *everything.*

He lowered his attention to Flattery who still sat himself cocooned in the action couch, seeing the sense of defeat in the curve of the man's shoulders and the set of his face.

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Why is he so quick to accept defeat? Bickel wondered. *It's almost as though Raj wanted defeat.*

The answer came to him on the heels of the question: *If you're programmed for destruction, you have a need for destruction.* With a sense of growing awareness, Bickel turned to look at the Ox construction, focusing on the angles and blocks and the tangle of neuron connections.

But I've programmed this beast for violence.

Forcing himself to appear calm and natural, Bickel shifted the jackboard for a diagnostic check on the program, traced out the condition of the routine. His throat went dry as he scanned the read out.

The embryo he had placed at the Ox's mercy—it was dead. No . . . dead was too simple a word for what had happened to that embryo. It had been disintegrated, torn asunder, broken down to its constituent molecules. The record was all here on the tapes and discs, betraying also the reason for the destruction.

Prue's question.

The embryo had been subjected to a violent experiment in the computer's search for information.

A violent and *useless* experiment. This certainly could not have produced much data—except for some of the more grossly apparent characteristics of acid phosphatase—and perhaps negative data about her biochemistry.

It'll kill to get information, Bickel thought. *It has an ability of sorts to accept motivation . . . if we give it motivation.*

"We've just lost another sensor," Prudence said, reading the telltale on her board.

"Second pi, fourth ring and in behind number five shielding layer," Timberlake said. "That's damn' close to the hyb tanks."

"I'll check it," Flattery said, unlocking the bottom of his couch. He swung his feet to the deck, slipped his helmet forward, but left it unsealed.

"Is there a robox-R in that area?" Bickel asked.

"What's the difference?" Flattery asked. "By the time we found one and traced out the control sequence . . ."

"Are we going to check that sensor or aren't we?" Timberlake demanded.

"I'm on my way," Flattery said. *I mustn't let Tim pre-empt this job,* he thought. *I need the excuse to go past quarters for a quick check on what Bickel's done. It's something violent and dangerous. He has himself under very thin control.*

"Raj," Prudence said.

He turned at the hatch.

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"That . . . thing down there in the shop *could* reproduce itself with no help from us. Every machine tool, every robox monkey, every muscle and sensor is programmed through the computer. Once the last tie-in is made . . ."

Flattery wet his lips with his tongue, ducked out through the hatch without answering her.

"That goddam' slowpoke," Timberlake said. "I should've gone myself."

Prudence shifted a corner of her board to monitor Flattery's progress. She glanced up at the screen. Bickel was staring back past her at the hatch where Flattery had gone.

"Prue, do you have a fix on him?" Bickel asked.

"He has a prime repair dolly and he'll be at the trouble spot in another minute or so," she said.

"That thing's down near the temperature-control shutters in the baffle to the hyb tanks," Timberlake muttered. "Too goddamn' close to them. You getting any heat shifts on the other sensors?"

"Nothing significant," she said.

Prudence flicked a switch, watching the shifting factors of temperature-weight-sound on her board, the telltales moving with Flattery. She hit another switch, said: "Raj, how much longer?"

Flattery's voice came out of the overhead command vocoder: "Another minute or so."

They waited in silence, listening to the sounds of Flattery's progress through the open command vocoder.

Prudence activated a guide beam to the dead sensor as Flattery passed the waterbaffles.

"Baffles secure?" she asked.

"All secure," Flattery said.

He dogged the last hatch, knowing the action would register in front of Prudence in Com-central. The action sent a faint fear response through him, though. He had symbolically cut himself off from the core of the ship.

I'll fix this sensor and get back to quarters as soon as I can, he told himself. *It'll seem natural for me to stop off there on my way back. I have to find out what Bickel's done, but I can't make him suspicious.*

Flattery turned, studied his surroundings. He stood in the bulb-lock that served as a hub for outer-hull communications tubes in this sector. It was an oval for strength, about six meters across its short diameter, and seven meters deep. He oriented himself by the faint pull of ship gravity.

The non-functioning sensor was up a tube that curved off at

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two o'clock on his right. Tube eight, ring K. The number checked. The failure would be at the five-line up there. He stared into the pale gray metal gap illuminated by cold light. A green guide beam beckoned in the tube.

Prue remembered to set the guide beam, he thought.

He took the repair dolly in his left hand, made the low-grav leap across to the tube and caught its access rung. He pushed the dolly ahead of him, setting its sensors on the printed track, fed it low power to pull him into the tube.

The auto lock's sphincter closed behind him. He suddenly remembered Anderson strangled in a rogue sphincter . . . but of course that was no problem now . . . with all the OMCs dead. The fact that one of the crew had to come out here and make this repair meant the dangers were of another sort—rogue consciousness.

"Something wrong?" Prudence asked, her voice filling his helmet.

She saw the telltales stop here, Flattery thought.

It gave him a feeling of reassurance that she was so alert to his movements—or lack of movements.

"Nothing wrong; just being cautious," Flattery said.

"You want Tim to come out and back you up?" Prudence asked.

"I don't need anyone to hold my hand!" Flattery snapped, and he wondered at the sudden anger he'd thrown into that rejection.

"You're at station Two," Prudence said. "There's video on Two. Check."

Flattery glanced up at the ring of sensors on the tube, saw the one circled with yellow for video, waved at it as he passed.

The robox-R's imprinted track curved slightly up the tube side to clear the base bulge for the next automatic lock. He went through, looked back as the transparent shutters squeezed closed behind him. The ship's core *felt* so far away back there.

He looked forward, letting the robox unit tow him with its faint hissing growl, letting the loneliness seep through him. With an OMC in control, an automatic robox repair unit could have been sent on this little chore. Mobility, that was the problem. Where there were fixed automatic repair units—along the outer hull and at the major bulkhead locks, at the baffles and core-integrity barriers—the ship took care of itself with only a little help from its crew. But let a little thing like this come up where you needed mobility and a decision factor. Then one of the crew had to risk himself.

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Flattery cursed the *Tin Egg*'s designers then. Hate poured out of him. He knew why they had done this—the "planned increment of frustration" they called it. The ship's designers didn't have to experience the frustration.

He was at station Four now, coming up on Five.

"Station Five coming up," he said. "Hey!" He cut the power on the robox, braked himself against the station's ring, stared up at the overhead arc of sensors.

A neat, shiny hole plugged with gray foam-coagulant occupied the position where the multi-sensor had been. The yellow-green-red code rings on the tube around the hole had not been touched. He swung his gaze around the tube and the other sensors. All appeared to be functioning.

Flattery thought then of the island on Puget Sound — sensors missing mysteriously . . . personnel missing. He felt cold sweat around his shoulders.

Prudence's voice filled his helmet: "Anything to report?"

He lowered the volume, said: "The multi-sensor seems to've been cut out in some way. It's gone. The hole's been plugged with foam."

"No foam automatics in that area," Prudence said.

"The things been plugged with foam anyway!" Flattery said, unable to hide the angry irritation in his voice.

Prudence said: "John, I'm getting a demand drain on the computer. Is it something you're doing?"

"Nothing," Bickel said.

Flattery turned his head in the helmet. Bickel's voice had come in faintly as a pickup through Com-central. *Action in the computer!* Flattery forced himself to act calmly, removed a replacement sensor from his robox unit's parts compartment, checked it. The thing was about three inches in diameter containing a warp-type thermal detector, standard vid-eye pickups like tiny jewels on its face, and three gridded ducts leading in to the membrance of the audio unit.

Out of the corner of one eye, Flattery detected movement up the tube. He jerked upright, banged his head against the helmet liner, stared up toward station Six.

A robox-R with its tool extensors clamped tightly to its sides was moving along the tape track toward him. The thing acted sick — speeding and slowing.

His first thought was that Prudence had traced the robox remote controls for a unit in this area and was maneuvering the thing from her board. The crudi-

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ty of Com-central's controls over the robox series would account for the unit's erratic behavior.

"You bringing another robox in here, Prue?" Flattery asked.

"No," she said. "Why?"

"There's another robox-R coming down on this station."

As he watched, the thing lost the tape track, relocated it.

"There can't be!" she said. "Nothing at all shows on my board."

The thing stopped across the sensor ring from Flattery. An augur extension jerked away from its side, reached toward the foam-plugged hole, withdrew.

"Who's controlling that thing?" Flattery demanded.

"Not from here," Prudence said. "And I can see both Tim and John. They're not controlling it."

"You still getting drain on the computer?" Flattery whispered.

"Yes."

"Is the . . . Ox active?" Flattery asked.

"Only the original circuits," Bickel said. "Through the AAT bypass. The new doubled units haven't been connected."

"There can't be another Robox in that area," Prudence said. "We haven't put any of the damn' things on automatic. There's nothing showing on my board. The remotes would take a day and a half at least to . . ."

"It's right in front of me," Flattery said.

He watched it, fascinated. A tool arm extended with an empty sensor socket, reached toward the foam-plugged hole, retreated. A claw arm came up next. It probed the foam, drew back with a swiftness that startled Flattery.

"What's it doing?" Prudence asked.

"I'm not sure. It seems to be looking over the damage. Its vid-eyes are turned toward the hole. It acts like it can't decide which tool to use."

"*What* can't decide?" That was Timberlake, his voice faint over the Com-central relay from the shop.

"Try fixing the sensor yourself," Bickel said.

Flattery swallowed in a dry throat. He lifted a feeler with a guide eye from the tool pouch on his own robox, probed into the foam plug looking for the leads from the conduit.

Instantly a whip-like extension shot out of the other robox, trapped his arm, jerked it away. The pain in his arm where the thing had clamped on it was sharp and shocking. He dropped the tool, yelled.

"What's wrong?" Prudence demanded.

The whip-like extension slowly unwound, released his arm.

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"The thing grabbed me," Flattery said. His voice was shaky with pain and surprise. "It used its circuit probe . . . grabbed my arm."

"It won't let you make the repair?" That was Bickel, his voice coming in loud over the helmet system, indicating he'd plugged into the command circuit from the shop.

"Doesn't look like it will," Flattery said. And he wondered: *Why doesn't one of us say what this thing has to be? Why're we avoiding the obvious?*

With an abrupt sense of purpose, the other robox reached out a claw arm, lifted the replacement sensor from Flattery's left hand, matched sensor and socket. Another claw arm recovered the feeler guide, fitted it to the connections of its own circuit probe.

"What's it doing now?" Bickel asked.

"Making the repair itself," Flattery said.

The feeler came out of the hole pulling the leads.

"John, what's showing on your meters?" Prudence asked.

"A slight pulse from the servo banks," Bickel said. "Very faint. It's like the cycling echo of a test pulse. Are you still showing current drain in there? I don't have it here."

"Drain from the mains into the computer," she said. "You should be registering it."

"Negative," Bickel said.

"It just fitted the new socket and sensor into the hole," Flattery said.

"It brought the correct spare parts?" Bickel asked.

"It took the sensor I brought," Flattery said.

"It just took it from you?" Prudence asked.

"That's right."

"Prue, that test pulse is stronger," Bickel said. "Are you sure nothing on your board is doing it?"

She scanned her console. "Nothing."

"Job's finished," Flattery said. "What's the big board show, Prue?"

"Sensor in service," she said. "I can see you . . . and it."

"Try touching that new sensor, Raj," Bickel said.

"The thing damn' near took my arm out the last time I tried that," Flattery objected.

"Use a tool," Bickel said. "Something long. You've got a telescoping radiation probe there."

Flattery looked into his robox unit, removed the telescoping probe. He extended it to its limit, reached toward the sensor, touched it.

The whip-arm flashed out of the other Robox. There came a

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jolting shock and Flattery stared wide-eyed at the stump of the probe in his hand. The severed end drifted upward along the tube, tumbling from the force of the blow.

"Keeerist!" That was Timberlake, proving they had the shop's screen switched to this circuit and were watching.

Flattery swallowed, spoke in a muffled voice: "If that'd been my arm. . ."

He stared at the other robox. It sat there, quiescent, its vid-eyes pointed toward him.

We're playing with fire, Flattery thought. *We don't know what's guiding that robox. It could be a repair program we've accidentally activated. It could be something the Tin Egg's designers built into the ship.*

"You'd better get out of there, Raj," Prudence said.

"No, wait!" Bickel said. "Raj, don't move. You hear me?"

"I hear you," Flattery said. He stared at the robox, realizing the thing could cut him in half with one blow from that whipping circuit probe.

The sound of distant activity came through the helmet phones to Flattery.

"I should have the full computer showing here," Bickel said, "but I can't find that damn' robox anywhere on my board. There's not even pulse resonance in any of the loops to hint at the source of control."

"I can't stay out here forever," Flattery whispered hoarsely, his mouth dry.

"What's showing on the meters, Prue?" Bickel asked.

"Still getting computer drain . . . and that pulse."

"Raj has been outside the shields for sixteen minutes," Timberlake said. "Prue, what's the radiation tolerance level for his area?"

She crossed the comparison lines against the time gauge on her main board scope, read the difference. "He should be back inside the shield lock within thirty-eight minutes."

Movement up the tube caught Flattery's attention. The end of the radiation probe. It had reached the top of its energy curve, was beginning to fall back down toward the grav center in the core of the ship. As the severed end of the tool neared the other robox, the tip of one of its sensor arms — just the tip — turned to track the passage.

That minimal activity, that *watchfulness,* filled Flattery with greater dread than if the robox had attacked the length of tool and torn it apart. There was a sense of waiting about the thing — of waiting and gathering information.

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"Raj." It was Bickel's voice.

"Yes?"

"Is there any information in the computer — even a hint — that you might destroy it?"

Did he send me out here to trap me into answering that question? Flattery asked himself. But the fear in Bickel's voice ruled out that suggestion.

"Why?" Flattery asked.

Bickel cleared his throat. "It was programmed to fill in the blanks in its information, Raj, and I put no limiting factor on that. The violence proves it'll stop at nothing to maintain its own informational integrity. If you pose any threat at all. . ."

"You're saying it's conscious?" Prue asked.

"Not the way we're conscious," Bickel said. "Like an animal. Aware. And with at least one drive we can recognize: self preservation."

"Raj, answer the question," Prue said.

She knows the answer, Flattery thought. He could hear the awareness in her voice. *Why doesn't she answer it for me?*

"The computer may well have such information in it," Flattery said.

And he thought: *I'm trapped! I must get back to quarters, destroy this thing . . . it's already out of hand. But if I move, it'll kill me.*

He stared at the other robox. There was the thing that gave the computer mobility — the thousands of special-function utility robox units throughout the ship . . . even the one under his hands — if it were shifted to automatic and keyed for program control . . . and if a consciousness directed it. These were what gave the Ox-cum-computer its gonads and ovaries — these and the computer-linked tools.

"Would . . . it react with violence if Raj tried to move?" Prudence asked.

Silence.

"What about it, Bick?" Timberlake asked.

"Very likely," Bickel said. "You saw the violence it used when he tried to touch that sensor."

"What would you do if someone poked a finger in your eye?" Timberlake asked.

"It's approaching me," Flattery said, and he felt a flicker of pride at how calm his voice sounded.

"Stay put," Bickel said. "Tim! Take a cutting torch and . . ."

"I'm on my way," Timberlake said.

"Raj . . . I think your only hope's to play dead . . . remain absolutely still," Bickel said.

A sensor tip was in front of Flattery's eyes now and he found

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himself staring for a second into a baleful red and yellow glow. The tip retracted, and the robox backed off a half a meter.

"Let go of your own robox," Bickel whispered.

Flattery saw his own knuckles white with the force of their grip on the robox control bar. He relaxed the hand.

"Gravity will set you drifting presently back down the tube," Bickel whispered. "Just let it happen. Stay limp."

The motion was barely perceptible at first.

"The locks are part of the central system." That was Prue's voice. "What if they don't . . ."

She didn't finish the question, but it was obvious she, too, remembered how the rogue sphincter lock had crushed the life out of Anderson.

Now, Flattery could see he definitely was drifting back. The two robox units receded up the tube. And that sensor tip remained pointed at him.

The first lock passed his eyes. *It had opened!*

But the lock's transparent leaves remained open after his passage and that ambient robox was following, hesitantly at first, then faster.

The AAT klaxon blared in Flattery's helmet, transmitted through the open net from Com-central.

"Oh, Jesus!" That was Prudence.

"Was the transceiver open?" That was Bickel.

"The message is already into the system," Prudence said. "We left it on automatic."

"Tim, where are you?" Bickel asked.

"At the hub lock," Timberlake said.

"Take the message, Prue," Bickel said. "Visio."

Relays clicked as she shunted the AAT to Com-central. Presently, she said: "Short and sweet. Hempstead tells us to cease ignoring communications. We are ordered to turn back and make no mistake about it. Odd choice of words: 'This is an arbitrary turn back command.' "

"He knows what he can do with his arbitrary turn back command," Bickel said.

At the sound of Prudence's voice, Flattery had gone cold. The chill of ice water gripped his chest. '*Arbitrary turn back command.*' It was the coded order he had both dreaded and almost longed for — the 'kill ship' command.

Flattery felt his body knotted by frustration. Here he was out beyond the shields of the core. He had been conditioned to accept this order and execute it, sacrificing himself for the pro-

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tection of the race. At this point, he couldn't muddy his mind with fanaticism. He knew the dangers to the human race from a runaway mechanical consciousness that nobody could . . .

A yell escaped him as something grabbed his leg.

"It's me, Raj."

Timberlake's voice. It filled Flattery's helmet phones, but he took a moment to accept the identification emotionally. His heart was still hammering as Timberlake pulled him past the next ring of sensors.

The nemesis robox increased its speed, maintained a distance of about three meters.

"Shall I burn it?" Timberlake whispered.

"Do nothing hostile," Flattery said.

The edge of the hub chamber entered Flattery's field of vision. Timberlake's hand released his ankle. Flattery felt the grating thump as the hatch to the inner lock was opened.

"In we go," Timberlake said. He gave Flattery a gentle tug as they drifted down into the hub chamber.

A lock stanchion came in front of Flattery and he grabbed it, feeling the inertial pull as he checked his motion. That following robox had stopped at the tube exit above them, but its sensor tip remained pointed at them. Timberlake moved in front of him, cutting off the view of the robox. Flattery backed down through the lock's baffle angle, Timberlake following. The hatch was closed. Timberlake dogged it, turned.

Flattery crossed to the other hatch, breathing easier now that they were behind the shields and with a hatch between them and that robox. He grabbed the hatch dogs, twisted.

They remained firmly locked.

He applied more pressure.

The dogs wouldn't budge.

"Come on, let's go," Timberlake said. He added his hands to the effort.

The dogs remained seated as though frozen.

Flattery and Timberlake looked at each other, their faceplates almost touching. Flattery's hands felt slippery with perspiration inside his gloves. He could smell the stink of fear within his suit.

"Go . . . try the other hatch," Flattery said.

Timberlake nodded, kicked back up to the baffle and the hatch they had just dogged. Flattery could see Timberlake's muscles lift the shoulders of the suit with the effort of trying to reopen the other hatch.

It was obvious the other hatch was blocked, too.

Timberlake dropped back

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down beside him, thumbed the command circuit switch beneath his helmet. "John."

"John's temporarily off the circuit," Prudence said. "You're out of danger . . . immediate danger?"

In short, clipped sentences, Timberlake reported.

"Trapped?" she asked. "How could you be?"

"Something's jammed the hatches," Flattery said. "Why's John off the circuit?"

"Oh . . ." Pause. "He left his helmet . . . down there. He just yanked it off, unplugged, grabbed up a bunch of equipment and headed for quarters."

"Your sensors! Where do they show him?" Flattery demanded.

Silence.

Then: "In your quarters, Raj. I don't understand."

"What's this equipment he took?" Timberlake asked.

"A whole pile of stuff," she said, "mostly from that bin where you were working, Tim, under the middle of the bench."

In my quarters, Flattery thought. *Our 'organ of analysis' didn't miss a thing!*

"Tim, your torch," Flattery said. He pointed to the cutting torch on its tool clip at Timberlake's waist.

Timberlake shook his head. "A minute ago you were saying do nothing hostile."

"Give me that torch!"

"No, sir, Raj. You know what's out there jamming that hatch as well as I do. Another robox unit or two or four or fifty. You had the right idea the first time. Let Bickel . . ."

"Don't you know what Bickel's doing?" Flattery demanded, not trying to keep the desperation from his voice.

"Just as well as you do, Raj. I assembled most of that gear in the center bin according to his schematics. It's a field-effect generator synchronized to a shot-effect generator. There's an electorencephalographic feedback unit . . . a manamplifier, he calls it."

"White box-black box," Flattery said. "We've got to stop him."

"Why?"

"He'll wreck the computer," Flattery said.

"Not *that* computer."

Bickel has infected him with this cynicism, Flattery thought. And he said: "Then he'll kill himself."

"That's his lookout, but I don't think he will," Timberlake said.

"When that shot-effect hits him, his muscles will break every bone in his body!" Flattery said. "That's a hideous way to die."

"Maybe if he were connected directly to the generator," Tim-

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berlake said. "But he won't be. He's going to get the shot effect through that generator's field — attenuated, buffered."

"Do you know what's in my quarters?" Flattery asked.

"A snooping device of some kind," Timberlake said. "I've seen the clues on the meters."

"A field sorter," Flattery said. "It's tuned to the computer, gated for output. If Bickel takes out those gate circuits . . ."

"And he will," Timberlake said. "Now sit down and be quiet. It's our only chance."

Flattery glared at him. "If Bickel turns that mechanical monster loose it could wipe out the Earth!"

"Why don't you try ghost stories for a change?" Timberlake asked.

"I don't have time to tell you the whole story," Flattery said. "That monster has to be stopped. You've got to take my word for it."

"You're nuts," Timberlake said, but Flattery could see the idea had touched the life-systems engineer's deepest inhibitions.

"You're an engineer," Flattery said. "You're a structuralist. You know Bickel's reasoning."

"What're you driving at?"

"He's arguing from the internal evidence of the human body," Flattery said, speaking with desperate quickness. Timberlake had to be made to try to cut them out of here! "Structure's vital to the mechanical origins — teeth, jaw muscles, digestive system and so on. The evidence says humans are descended from carnivores. And he insists a killer instinct is an absolute necessity for a carnivore."

"Are you saying a killer instinct is a necessary preliminary to consciousness?"

"Bickel's saying that! I'm not."

"Ahhh . . . you're making this up."

"Give me that torch."

"No." Timberlake shook his head.

"I'm going to take that torch if I have to kill you to get it," Flattery said. He inched toward Timberlake.

"Prue, did you hear this madman?" Timberlake asked, backing one step.

The command net remained silent.

"Prue?"

Flattery drew himself up straight, his own words replaying in his mind. ". . . *if I have to kill you to get it.*" He felt suddenly that he had been herded into a completely vulnerable corner.

Killer instinct? he wondered.

"Prue!" Timberlake called. Then: "Raj, snap out of it! Prue isn't answering!"

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Flattery had stepped backward. He felt nausea, extreme chill, a shaking in the calves of his legs and in his shoulders. Half-screened thoughts flitted about on the edge of his awareness.

I'm avoiding something, he thought. *Hiding my awareness from something . . . that . . . frightens . . .*

"What's wrong with you, Raj?" Timberlake demanded, and there was sudden concern in his voice.

Flattery put out a hand, grasped a stanchion to keep himself from collapsing. He closed his eyes, conjured up the image of the sacred graphic imprinted on his cell in quarters — picturing against his eyelids the field of serenity with its suggestion of holy faces and the dynamics of the over-printing that combined the religious symbols on which men had spent their faith and yearning.

They that wait on the Lord shall renew their strength, Flattery told himself. *Lord, let this strength be transformed in the renewal of our minds. Let us share thy light.*

The litany hung suspended in his consciousness, focused on the word "mind" and Flattery's mental image of the sacred graphic took on motion. The field of serenity and sacred symbols dissolved into writhing atoms, drew a new pattern like the outline of a great river with its watershed.

Flattery opened his eyes to find the interior of this metal trap where he stood with Timberlake washed in golden light — glaring, yet soft.

Timberlake seemed unaware of the light, frozen in some private instant.

And Flattery found himself caught by the wonder of that revelation — a great river and its watershed.

All men are parts of the total stream, he thought. *We are tributaries — and our minds are tributaries, and our most private thoughts. Every pattern in the universe contributes to the whole — some gushing like a freshet and some no more than a single touch of dew. All structure is an expression of the same law.*

The law was like a pulsing thread that he could experience but not express. Simplicity. He felt it in the touch of the suit's fabric against his skin, in the awareness of the washed air entering his lungs, in every sensory impression.

How clean and unique was this shower of molecules upon his person and this place he occupied in the dancing pattern.

"I thank thee, Lord, for this enlightenment," he whispered.

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And Flattery held himself in this supraliminal awareness, staring now at Timberlake. Timberlake appeared to him . . . somehow dead. He moved, but his eyes behind the faceplate were like holes in skull sockets. Each movement was the stick-shaped articulation of a skeleton.

Remembering Prudence and Bickel — Flattery felt they shared this deadness: eyes empty of life. Their breasts had moved with breathing, but the labored irregularity of that motion contained the same pattern (differing only in degree) as the breathing of a terminal sickness, the breathing of a dying person preserved beyond his time by artificial means.

We're doomed, Flattery thought. *Lord, why didst Thou enlighten me only to show me this?*

The skeleton-like Timberlake and dead-alive images in his memory filled Flattery with rage. He pulled himself upright against the stanchion, screamed: "You're dead! Zombies! You're already dead!"

As quickly as the rage had come it fled him, and he felt himself crying softly. The feeling of enlightenment drained away. It had come in the space of ten heartbeats and left in the space of a single pulse. The golden light faded and the plasteel lock that trapped him with Timberlake was only that — a room of too solid walls, too small, its light too cold, and the air his suit provided was too charged with the omnipresent stinks of recycling.

"Raj, you've got to control yourself," Timberlake said.

He took a deep breath, feeling the tightness in his chest. He felt faintly ill, his fear at their helplessness compounded by Flattery's near panic. He and Flattery were as trapped here as that cow embryo had been. Timberlake knew it.

He thought of that helpless embryo in the Holstein section of the farm stock hyb tanks — a bit of protoplasm attached to the life system tubes with its own special code. It had been a unique identity, and Timberlake felt he had known that particular animal — could project its lost potential forward in his mind to see it grazing and fulfilling its natural functions as a producer of energy.

All that natural potential had been sacrificed, becoming merely units of cerebral excitation in the development of a mechanical consciousness. Any other function or possibility had been lost in the instant of its deliberate destruction. It had become a thing of the senses — unreal, receding into the past, its atoms

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dissipated in the Time void. There could be nothing private or individual or unique about it from that instant of death onward.

Timberlake swallowed. His throat felt sore as though from remembered anguish. He knew this feeling was rooted in his training as a life systems engineer — his inhibitions as a preserver of life. He shook his head, trying to drive out the sense of confusion.

It was an unborn creature, an animal, he told himself. *It wasn't really a being the way we are beings. The physical complexity of that dead creature was enormous, yet it never could have been conscious the way we are . . . even if it had lived out its normal life.*

"Take it easy, Raj," Timberlake said. He spoke softly, as though soothing a child who had been hurt. Then, louder: "Prue?"

Still no answer.

She could be too busy to answer, Timberlake thought.

He listened to the gentle burbling and whirring of his suit, assessing their position. Prue wasn't answering — reason unknown. Bickel had taken off for his quarters — obviously intent on completing the white box-black box step in his theory, transferring his own pattern of consciousness onto the white box that was the Ox-cum-computer. Would the Ox be like Bickel, then? No . . .

Timberlake felt suddenly that he had passed beyond some major obstacle in understanding his own personal mind-brain relationship. He sensed that he had entered a new, but as yet unidentified territory.

Something Bickel had said while they worked on the Ox rose up then in Timberlake's mind:

"If we give this thing life, we have to remember that life is a constant variable with eccentric behavior. The life we create has to think in the round as well as in a straight line — even if its thinking is derived from patterns on tapes and webs of pseudo-neurons."

The whole form of their problem arrayed itself in Timberlake's mind with the sudden force of something thrown at him. Problem and solution set themselves up as a physical arrangement and he saw the nerve nets they had built all arrayed as a series of triangular faces with a moebius twist — prisms of cell triangles interlaced and marching with their energy flows through infinite dimensions, forming sense data and memory images outside conventional space, storing bits and altering relationships in limitless dimensional extensions.

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A moebius twist permitted humans to manipulate this infinite array in four dimensions.

It was as though consciousness were a valve whose function was to simplify. All the complexities had to flow through it and be reduced to an orderly alignment.

Energy flowed into the system at all times — enormous amounts of energy — sufficient to overload a conventional four-dimensional system.

Overload - overload - overload! Down it poured through the valve of consciousness. As the load increased, the valve could deflect it . . . or expand to receive it.

Timberlake felt that he moved up through enormous layers of fog — layer upon layer upon layer — until he reached a place of clarity and balance.

I am awake, he thought.

XIV

Flattery's personal cubby was enough like his own to give Bickel a sense of familiarity, but sufficiently different to fill him with disquiet. The life system ducts appeared conventional — a breather grid with its cap swung aside and the tube and mask clipped in their racks, the dome of repeater gauges above the action couch, atmosphere samplers normal.

The sacred graphic imprinted on the bulkhead in front of the couch drew his attention. It was a compelling thing in pastel shades of blue, red and gold with a dark and wavy hypnotic overprint suggesting faces out of dreams.

Bickel tore his attention from the graphic, studied the room's electronic equipment. The cubby's installations contained a surprise, and Bickel examined it carefully. No doubt about it — the thing like a stiffened net that swung out over the couch from the side bulkhead bed impulses to a weaker, but more sophisticated version of the field generator/sorter he had designed for the black box-white box transfer. He traced the leads, found another surprise: the thing had been gated for oneway operation. It impressed its field reflections onto the cubby's occupant, but nothing of the occupant returned to the ship system.

Bickel absorbed the implications of the device, nodded slowly.

Presently, he stretched out on the couch, ran a short test on the generator, swinging the controls close, keeping his eyes on the gauges and the half-curve of the net-grid which swung down on its rack to a position about ten centimeters above his head.

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It took a few seconds for the generator's field to build up, then he felt a curious sense of watchfulness — an observing-without-emotion. It was like a waking dream. He thought immediately of reflector. Like a mirror in an angle of a hall to reveal people around a hidden corner — a one-way mirror that revealed only that alert watchfulness.

He saw at once that this installation gave a sensitized person the *mood* of the ship's computer.

He felt a vague sensation as though his viscera had been exchanged for great baths of mercury, for discs and spools and tapes and print drums, that his nerve ends had been transmuted into thousands of delicate sensors reaching into strange dimensions.

But it was yet a dream. The great creature of wires and pseudo-neurons, not fully awake to itself, lay watchful and alert but with its full potential still held in a rein of somnolence.

The mood changed.

Slowly, Bickel felt the field gear itself to his reflexes. He felt it arming him with a total-involvement program as though drawing a bow to its full capacity, marshalling his energies and throwing them suddenly into an afferent loop.

With a semi-detached feeling of shock, Bickel saw his own right hand slam out and open a panel concealed by the lines of the religious graphic on Flattery's bulkhead. Behind the panel lay a trigger, red and ominous. Bickel found himself barely able to withhold his hand from that trigger. He slapped his left hand against the cut-off switch beside the couch, felt the generator's field whine down to silence.

Still his fingers itched to push that red trigger.

He realized then how deeply Project had infected this ship with self-destruction failsafe devices. He had been conditioned for the job . . . and doubtless all the other crew members, too.

Then how could I resist the conditioning? he wondered.

The implications filtered slowly through his awareness and he saw that he had been existing for days on a threshhold above his reflexes, permitting some, inhibiting others — poised and waiting. For . . . something.

Bickel stared at the red switch. That was the ship-killer to which Flattery . . . to which all of them had been wedded.

Slowly, his palms wet with perspiration, Bickel eased himself off the couch, closed the false panel over the switch, began altering Flattery's field generator installation. The gate circuits showed up immediately on the

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color-coded sheafs. Bickel ripped them out, jacked in his own amplifier, began installing the black box-white box circuitry.

The work went rapidly: clip-in, test; clip-in, test.

Now, he took the constant-energy source: a single plastic-sealed block—air-bearing motors and spools, edge-coded tapes with moebius twists for continuous-loop operation, a single output through an Eng multiplier. He checked it, saw the strong, eccentric pulse on the meter, plugged it into the circuitry.

It was done . . . ready.

A deep sense of loneliness washed through Bickel then. He returned to the couch, stretched out on it, opened the command circuit transmitter, left the receiver dead.

"Now hear this," he said, thinking how his voice would roll out of the vocoders and shock the others to silence.

"I'll be starting the white-box interchange in just a few seconds," Bickel said. "I've jammed the locks into quarters and my receiver's turned off. Don't waste your time trying to get in here or calling me."

(Out in their lock trap, Timberlake turned, peered into Flattery's faceplate, saw the terror in the man's eyes.)

"Everybody sit tight," Bickel said. "Don't try violence of any sort. That killer program's still loose in the circuits. The reason I decided to go ahead with this . . ." he paused, swallowed. "Tim, I'm sorry, but I got no response from two hyb tank units. I think it may've killed two colonists the way it did with the embryo. It's searching . . . experimenting . . . curious, like a monkey."

(In the lock, Timberlake experienced a shortening of breath, felt himself sinking back through the layers of fog. There was a sensation like hunger in his stomach. *Two colonists killed, Oh, God!*)

(In his position beside Timberlake, Flattery clutched a stanchion, asked himself: *Where is Prue?* He thought of the ship hurtling onward with no one at the big board . . . Prue a lifeless mass of protoplasm drifting somewhere in the control room. He closed his eyes, thinking: *But I'm the ship's prime target. If it kills now, it'll kill me . . . to protect itself.* He opened his eyes, stared around the metal walls of their trap. No way out. *We've turned on the terrible genie,* he thought, *and we may not be able to turn it off.* Then: *Where is Prue?*)

Bickel cleared his throat, said: "Use extreme care until I've removed the killer program. Anything in the ship could be a murder instrument, do you under-

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stand? The air we breathe, the reclamation systems, robox units, any sharp edge with poison on it . . . anything."

He depressed the first action switch, said: "Count down for field build-up starts in thirty seconds. Wish me luck."

(And Flattery thought: *He's committing suicide . . . but it may be a useless gesture.*)

Bickel watched the curve of gauges overhead. They registered power in the circuits, vocoder on and pulsing. A faint hum issued from the vocoder. It gave a sudden static burp.

Needles slammed against pins on the monitor dials.

A rasping came from the vocoder now. Slowly it resolved itself into a gutteral, almost unintelligible voice.

"To kill," it said.

Bickel studied the meters, saw the demand-drain in the computer, pulse action in the Ox circuits.

It was the computer speaking on its own, all right.

"To kill," it repeated, speaking more clearly this time. "To negate energy, dissolution of systems using energy in any form . . . symbolic approximations . . . non-mathematical."

Bickel activated a diagnostic circuit, read the meters. No energy in the command communications circuits, pulse in the Ox, low energy drain to the computer.

To kill.

He stared at his board, thinking.

Information conveyed out of a tape had an exact mathematical equivalent. The tape message was at least two messages. Probably many more. It was the functional message, the play of what it was supposed to do — supply, information, add, subtract, multiply, solve for an unknown . . . message precisely for a human operator according to how much information was conveyed.

Beyond this, Bickel wondered, *what?*

He knew he had not energized the system or imprinted his own brand of consciousness on it. Yet, the thing acted independently. He felt himself on the edge of aborting this step, calling in the others for consultation . . . but the deadliness of this monster remained. *To kill.*

Before he could change his mind, Bickel depressed the action switch on the re-worked field generator. He felt it building up around him, making his skin crawl. Every hair follicle tingled. His eyes watered and the backs of his hands trembled. He felt suspended in a basket of energy.

Something was fishing for him, casting out with a net, dangling

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hooked lines at him. He knew this for the symbol-juggling it had to be—the mind trying to box a new experience within known symbols.

One of the nets caught him.

The shot-effect burst hit him —an infinity of sparks.

It was like an electric shock, pungent with reality. He felt himself bound up in looped spirals, being towed with an undulating rhythm. His entire sensorium had become a worm being towed through a net . . . no: through holes and tubes and burrows. He felt that valves opened for him and closed behind him. It was like travelling through the ship's interior access tubes.

Except that he was a worm with every sense concentrated on his skin, seeing, breathing, hearing, feeling through every pore. And all the while he was being towed down that dizzy spiralling with an undulant rhythm.

Labels began flashing against that sensitized skin and he saw them with a billion eyes.

"aural sense data"

"linear accretion of information"

"latent addition adjustment"

"closed-system matching factor"

"16,000-year memory drop-off"

"total sense-quality"

"internal counting mechanism"

Internal counting mechanism, he thought.

His worm-self grew a pseudopod, jacked the moebius energizer into a flickering board.

Immediately, he felt the beat of it like another heart and the labels began flashing past faster and faster.

"psychorelation form-chart" . . . "sense-modality interchange" . . . "form-outline analogue" . . . "infinite submatrix channel" . . . "sense intensity adjustment" . . . "data overlap network" . . . "approximate similarity comparison"

The whole pattern of labels and valves began to make an odd kind of sense to him, a coherence within coherence . . . like a dream that had to be interpreted as a whole.

The probability of a sufficient number of cells in the computer failing at any given moment could be given as 16×10^{-15}. The fact loomed in his awareness. *16,000-year memory drop-off.*

The system in which he found himself was such that it had had a probability of losing one out of every 16,000 memories through system malfunction . . . but classification-memory in this context meant only a part of an incident.

Is this system the computer, or is it me? he wondered.

"YOU!"

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The sound slammed against every pore of his sensitized skin and he momentarily blanked out.

As he floated back, something whispered: "Synergy."

Synergy, Bickel thought. *Cooperation in work. Synergy. Coordination.*

"Human consciousness," something whispered. "Definition too broad. Generalized body and specialized brain — a relationship."

Past his skin eyes swept a pattern of interlaced lines, a lacing together. It writhed and knotted and locked, put out symbols and arrows.

A schematic!

It kept flowing past his awareness. Cell-net continuities arranged as equilateral triangles on their contact faces. Bundles of parallel circuits tripled, each functioning as a nerve net and each monitoring the other two nets in the tripled circuitry. They were grouped in afferent units at first. Each cell in a layer of a net had an excitatory linkage to each of the three synapses on the next layer.

Bickel felt himself being pushed then, herded, compressed. He became a single sensor, a videye looking down into Com-central.

All the action couches were empty and Prudence lay sprawled across the deck, one arm stretched out toward the hatch to quarters.

With a gestalt burst of awareness, Bickel realized she was near death. *Minutes!* This was real. He knew it was real. He was being shown through a ship sensor a reality within the ship. The big console above her empty couch winked and flickered.

Where are Raj and Tim? Bickel asked himself. *Is the ship killing them, too?*

The view of Com-central blanked out. Bickel floated in darkness where a voice whispered: "Do you wish to be disembodied?"

Instant terror was all the answer he could give. He could not locate his muscles or control his senses. *This must be something of what the mental cores experienced,* he thought. *They awakened to something like this . . . forced to learn new muscles. Am I being converted into a bodiless brain?*

"The universe has no center," whispered that surrounding voice.

Darkness so deep it was like a total absence of energy enveloped Bickel.

And silence.

But I'm conscious, he thought.

A disembodied consciousness? he wondered. *That's impossible. There has to be a body. But a body brings many problems.*

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Have I become part of the ship's consciousness?

He sensed breathing. Someone was breathing. And heartbeats. And muscle tensions.

Infinite numbers of pinpricks on countless nerve ends.

A bright pulse of light—painfully bright.

A diaphanous sensation of reality seeped through his awareness.

Now, he sensed himself retreating, still pounded by that multi-dimensional nerve bombardment. He felt himself pulling inward-inward-inward, a structure collapsing inward—through the sensation-oriented skin awareness of a worm-self—inward-inward. The nerve bombardment dulled, levelled off, and he felt himself to be merely a body of flesh and bone cocooned in a sleep couch.

An emotion of terrible loss poured through him. It was as though he had glimpsed heaven and been denied entrance. Tears pressed from beneath his eyelids, rolled down his cheeks.

Now, he saw what had happened to the Organic Mental Cores.

The human-type brain had been prepared genetically for manipulating a limited sensory input—self-limiting. They had thrust these human-type brains into a full-on situation, permitted them no real unconsciousness, inflicted them with the sensory input of an *organism* infinitely sensitive and more complex than the bodies of which they had been deprived.

The OMCs had tried to adapt, had grown heavier conduction fibers, added switching capacity . . . but it had not been enough. When the necessities of existence reached a certain fierce tempo, they shorted out their own internal connections. They died.

They had been forced into hyper-consciousness by the pressures of enormous sensory data and the lonely knowledge of responsibility. They awoke to the full potential of being humans, but couldn't be humans because they'd been deprived of their autonomic emotional register, the organism. The ship had no equivalents.

Prue is near death.

The thought lifted into his mind from some great depth.

Raj! Where was Raj?

A flicker of awareness drifted through his bruised nervous system. As though through a guaze screen, he saw Flattery and Timberlake trapped in the lock, robox units holding the hatch dogs tightly closed.

Raj has to get out of there to help Prue, he thought.

He felt the thought go out like a free-standing program, feed

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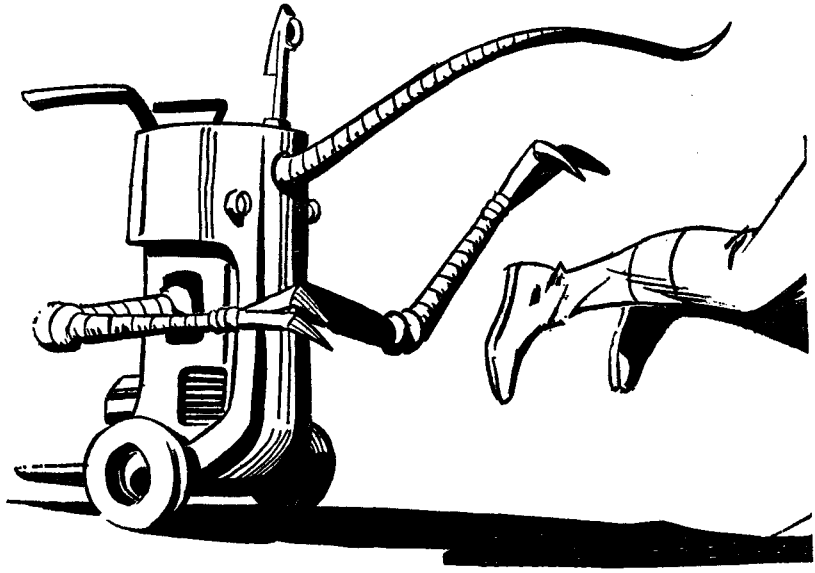

through a memory bank auxiliary while it gathered in the necessary data, become a reflexive pulse in control loops.

The robox at the inner hatch whirled the dogs, opened the hatch and scurried aside.

"Raj," he whispered. "Com-central . . . quick . . . Prue . . . help."

He sensed the amplified whisper booming out through the memory bank and the vocoder loops, become a roaring hiss in the lock.

Flattery was already out the hatch heading down tube toward Com-central.

Bickel felt himself fading. His awareness was a brilliant point of light that grew dimmer and dimmer, changing color as it went. It started almost violet, somewhere around 4,000 angstrom units, and traced a continuous wave shift until it flickered out at the red end.

In the instant before unconsciousness, Bickel wondered if he could be dying, and he thought: *Red shift! Awareness fades like the red shift.*

XV

Somewhere in his own consciousness, Flattery felt, an accumulation of answer-bits had poured out of their storage circuits, fed into an analyzer

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punched for decode and produced a terrible answer.

The ship had to be destroyed —and all its occupants with it.

As the lock hatch swung open, that one thought dominated him. He hurled himself through the hatchway and down the tube. Timberlake was close behind.

"You see that robox?" Timberlake panted. "What made it open up?"

Flattery sped on without answering.

"That voice," Timberlake said. "Was that Bickel, that voice? Sounded like Bickel."

They were at the Y-branch leading down to Com-central now, then at the hatch.

Flattery opened it, slipped through. His mind raced. Kill the ship now? Destroy this wild genie they had created? Timberlake mustn't suspect and try to stop me.

I must act normal, Flattery thought. *I must wait my moment.*

Prudence lay on the deck half way between hatch and couch.

Flattery knelt beside her, becoming totally physician for the necessities of this moment.

Pulse thin, ragged. Lips cyanic. Liver spots at her neck where it showed within the edge of the helmet seal. He loosed the hinged helmet from the back of her neck, pressed a hand there. Skin clammy.

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Did she think she was fooling me? he wondered. *She went off the A-S and was experimenting on her own body. Medical stores showed a gradual depletion of serotonin and adrenalin fractions.*

Flattery thought of the neuro-regulatory shifts, the psychic aches that would arise from manipulating body chemistry in this fashion. Prue's moods and strange behavior became clearer to him.

He stood up, retrieved the emergency medical pack from its clips on the bulkhead, saw that Timberlake had taken over on the big board.

What difference does it make if I save her? Flattery asked himself. But he returned his attention once more to the comatose woman, began ministering to her. He kept on checking her condition as he worked. No broken bones. No evidence of external injury he could find through her suit.

Timberlake had ignored Prudence after the first glance. She was Flattery's problem. He had darted across to his action couch, shifted the big board, keyed first for open circuits.

There was a sense of dullness in the equipment. He had to wait while servos hummed slowly about their work, while circuits balked and produced sluggish results.

He could feel his own hairline awareness of every control and instrument, his consciousness keyed up by necessity. The interrelation of every device in this room and throughout the ship was like a complicated ballet, a pattern growing simpler and simpler in his mind even through its slowness.

Timberlake made a delicate adjustment in hull-shield control, saw the resultant temperature change register on his instruments as a power shift in the radiation-cell accumulators, a miniscule shift of weight in the ship-as-a-whole brought about by adjustment in mass-temperature-proton balance.

But how slow it was.

And growing slower.

Timberlake swung his computer board to his left side, keyed for diagnosis, got no response.

Telltales were winking out on the big board.

With an increasing sense of frenzy, Timberlake fought to find the trouble.

Dead circuits.

No answers.

Keys on the main console began locking. No power in their circuits.

The last light winked out. Every key on the board was locked tight, all the servos silent. There was no whisper of air circulation fans, no pulse of life to be felt in

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the ship. Slowly, Timberlake swung his gaze to the right, staring at the hyb-tank repeaters. The lights were dead, but the physical analogue gauges still showed feeder fluids flowing in the gross ducts of the system.

The hyb tank occupants were not dead . . . yet. Whatever the settings had been when the board went dead, that was the balance remaining for each tank. As long as the auxiliary accumulators throughout the ship retained some power. As long as the pump motors kept running.

But the delicate feedback control and adjustment was gone.

"Bickel's really done it this time," he said to Flattery. "No power . . . computer off. Everything's dead."

All I need do is wait, Flattery thought. *Without power, the ship will die.*

But the effort of reviving Prudence had softened his determination. Living, after all, held its attractions—even if they were only a ship full of culture-grown flesh, duplicates, expendable units.

"*You are humans, never doubt that,*" Hempstead had insisted. "*What matter that you were grown from selected cell cultures of select candidates? You are still humans—completely. This method is merely good common sense. We don't want to lose our best people if the ship has to be destroyed . . . as the others were.*"

But if the ship died this way, it might not leave its capsule record to help the ones who came after . . . the next try.

"How is she?" Timberlake asked, nodded toward Prudence.

"I think she will recover."

"To what?" Timberlake asked. Then: "Do you want to go see what's wrong with Bickel?"

"Why bother?"

The question with its tone of utter submission to fate sent anger surging through Timberlake.

"Give up if you want," he said. "But if Bickel's alive he may know what he's done . . . and how to repair it." He pushed himself away from the couch, headed for the hatch to quarters.

"Wait," Flattery said. Timberlake's rejection had stung him and he found this surprising.

Have I acquired a new taste for living? Flattery wondered. *God—what dost Thou want?*

"You keep an eye on Prue," Flattery said. "It was chemical shock. She should stay quiet and warm. I have her suit heaters turned up. Leave them that . . ."

He broke off as the hatch from quarters slowly opened.

Bickel stumbled through it, would have fallen had he not caught a stanchion. A charred

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block of plastic slipped from his hands, tumbled to the deck. He ignored it, clung to the stanchion.

Flattery studied him. Bickel's eyes looked like two pits with dark smudges beneath them. His skin was powder white. His cheeks showed skull depressions as though they had wasted away in months of fasting.

"So your white box didn't kill you," Flattery said. "Too bad. All you did was kill the ship."

Bickel shook his head, still unable to speak.

The stillness of the ship had awakened him from a sleep so deep he could still feel the fog of it clinging to his mind. A profound weariness dragged at his muscles. Movement sent odd aches angling through his body, stirring this terrible torpor.

The first thing to catch his attention as he had awakened had been the moebius energizer, his *clever* installation to give the Ox a constant source of energy reference. A fan of gray char crackled from its broken seals and its motors lay silent. The virtually frictionless motors and spools, the thousand-year units, were blobs of fused plastic and metal.

It had taken several minutes for him to gather enough energy to move close to the unit and study it. His mind had labored over the simplest observations—charred insulation on the power leads and in the timing circuits . . . tape spools twisted out of line.

Slowly, it came to him: something had altered the power to the motors . . . and their synchronization. Something had tried to change the timing of this pulse . . . and its intensity.

Forcing the movement of every muscle, he had unplugged the unit, stumbled and crawled with it back to Com-central. The dead stillness of the ship pressed at him as he moved.

Raj . . . Tim . . . somebody with his mind turned on . . . has to see this, he thought.

But now that he had made it to Com-central, he couldn't find the energy to speak.

Timberlake recovered the fused energizer unit from the deck, studied it.

Flattery crossed to Bickel's side, felt the pulse at his temple, lifted an eyelid, looked at his lips and tongue. Presently, he stooped to the med-kit, removed a slapshot and pressed it against Bickel's neck.

Energy began to burn through Bickel's veins.

Flattery pressed a squeeze-bottle against his lips, said: "Here, drink this."

Something cool and tingling poured down Bickel's throat. Flattery removed the bottle.

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Bickel found a husky half-whisper that would serve him as voice, rasped: "Tim."

Timberlake looked at him.

Bickel nodded toward the energizer, began explaining what had happened.

Flattery interrupted: "Do you think the black box-white box transfer was completed?"

Bickel examined the question. He could feel his mind clearing under the pressure of the stimulant—and there in his memory was the sensation that the ship was his body, that he was a creature of hard metal and thousands of sensors.

"I . . . think so," he said.

Timberlake held up the block of plastic. "But . . . it destroyed this and . . . apparently shut itself down."

A thought began stirring in Bickel's mind and he said: "Could this be a message to us . . . a kind of ultimate message?"

"God telling us we've gone too far," Flattery muttered.

"No!" Bickel snapped. "The Ox telling us . . . something."

"What?" Timberlake asked.

Bickel tried to wet his lips with his tongue. His mouth felt so dry. His lips ached.

"When nature transfers energy," Bickel said, "almost all that transfer is unconscious." He fell silent a moment. This was such a delicate plane of conceptualizing. It had to be handled so gently. "But most of the energy transfers for all the enormous amount of data in the Ox-computer is routed through master programs . . . and total consciousness would turn all of them on, force the system as a whole to suppress some while letting others through. It'd be like riding herd on billions of wild animals."

"You gave it too much consciousness?" Timberlake asked.

Bickel looked at the transceiver panel of the Accept and Translate system beside his own action couch.

Timberlake turned, followed the direction of Bickel's stare.

Prudence stirred and moaned. Flattery bent to her. She said: "Fmmmsh."

Almost automatically, Flattery put a hand to her temple, checking her pulse.

She reached up, groping, pushed Flattery's hand away from her head. She tried to sit up. Flattery helped her.

"Easy now," he said.

She put her hand to her throat. How sore her throat felt. She had been absorbing the conversation around her for several minutes, remembering. She remembered there had been a train of thought, frantic efforts to raise Bickel on the intercom and communicate with him. She remembered the

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effort and the urgency, but the precise reason for abandoning her post and rushing off to tell Bickel eluded her questing.

"We have to weed false information out of our minds," Bickel said. "We're assuming a totally conscious robot, all of its activity directed by consciousness. That cannot be unless every action is monitored simultaneously."

His words aroused a vague sense of anger in Prudence. He kept skirting the . . . What was that thought?

"Would it have the illusion that it's the center of the universe?" Timberlake asked.

"No." Bickel shook his head, remembering: "*The universe has no center.*" That's what it had said to him.

A moment of intense despair overcame him. He felt like groaning.

"Life as we know it," Timberlake said, "started evolving some three thousand million years ago. When it got to a certain point, then consciousness appeared. Before that, there was no consciousness . . . at least in our life form. Consciousness comes out of that unconscious sea of evolution." He looked at Bickel. "It exists right now immersed in that universal sea of unconsciousness."

As though Timberlake's words had released a dam, Prudence remembered the train of thought so urgent it had forced her to abandon her post to go in search of Bickel.

Determinism at work in a sea of indeterminism! And she held the mathematical key to the problem. That was the train of thought. She had been trying to narrow down a new definition, mathematically stated, of quantum probability. She had sensed a three-dimensional grid forming in her awareness and a probing beam of consciousness focusing into that grid.

Grid, a given volume of space, dimensions x.y.z.

With the source of awareness, an invisible object (s) *to find in time* (t) *for a given operation within that volume.*

Again, she felt that enormous increment of consciousness and the memory of that sudden knowledge—she had pushed her body's chemistry beyond a balance point. She remembered how the darkness had engulfed her just as the mathematical beauty, the simplicity of the thought had spread itself out in her mind

"John," she said, "the Ox isn't the instrument of consciousness; it's the AAT, the manipulator of symbols. The Ox circuits are merely something this *manipulator* can use to stand up tall, to know its own dimensions. The Ox is the unconscious

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component. A machine for transferring energy."

And, still within this heightened awareness, she explained the mathematical clues that had led her to this point.

"A matrix system," Bickel said, remembering his own plunge into this way of attacking the problem and the blaze of consciousness that plunge had whipped up. "And sub-matrices and sub-matrices without end."

Flattery stood up, seeing where these thoughts must lead, dreading the moment of action to come. He looked down at Prudence seated on the deck, seeing her flushed cheeks, the glitter in her eyes.

"And where does this AAT cum Ox stand?" Flattery asked. "Have you thought of that?"

Prudence met his stare, understanding now why their hyb tanks had been filled with colonists. "The colonists," she said, nodding. "A field of unconsciousness from which any unconscious can draw—a —ground that sustains and buoys—and the *sleeping* colonists provide it."

Flattery shook his head feeling angry, confused.

Bickel stared beyond Prue, absorbing her words. Ideas merged and fitting orders evolved in his awareness. This ship had been armed, maneuvered, aimed and fired. He remembered Hempstead: gnome-wise face, eyes glittering, and that compelling voice saying: "*What matters is the search itself. This is more important than the searchers. Consciousness must dream, it must have a dreaming ground—and, dreaming, must invoke ever new dreams.*"

"Knowledge is pitiless," Bickel said.

Prudence ignored him, keeping her attention on Flattery, aware of the psychiatrist-chaplain's confusion. "Don't you see it, Raj?" she asked. "To separate subject from object there has to be a background of some kind. You have to be able to *see* it *against* something. What's the background for consciousness? Unconsciousness."

"Zombies," Bickel said. "Remember, Raj? You called us zombies. And why not? We've existed for most of our lives in a state of light hypnosis."

Flattery knew Bickel had said something, but the words refused to link in any understandable form. It was as though Bickel had said: "Hop limbo promise the insect watering class to be erected to a first behavior preserve." The words trailed off through his mind as though they had been flashed in front of his awareness to screen him from something else.

From what?

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XVI

A profound silence filled Comcentral broken by the sound of Prudence shifting her position on the deck.

Bickel felt himself go as calm as that silence, as though some other self had waited for that silence to take the reins. The sensation lasted for a single heartbeat and expanded into a sense of well being, a relaxed poise that illuminated everything around him. It was as if one universe had been substituted for another, as if a sensory amplification of enormous intensity had been turned on his universe.

He saw the stark unconsciousness in Flattery's face, in Timberlake's—and the semi-consciousness of Prudence.

Zombies, he thought.

"Raj, you called us zombies," Bickel repeated. "If we were lightly hypnotized we'd appear partially dead to someone in a higher state of consciousness."

"Do you have to mumble?" Timberlake demanded.

Flattery glared at Bickel. He felt that the man was using real words that communication was intended, but all the meanings slipped and slithered through his mind without making connection.

Prudence felt Bickel's words lifting her.

"Hypnotized," Bickel said. "We accept it as normal because it's virtually the only form of consciousness we've ever seen. You've watched the Earth video. You wouldn't expect an idiot to be fooled by the commercials, but that rhythmic hammering, that repetition . . ."

"Half dead," Prudence said. "Zombies."

She said, "Zombies," Flattery thought. Her voice frightened him.

Bickel saw the alertness spread through her eyes, the awakening.

"We should've thought of the AAT when the thing came alive during reception from UMB," Bickel said.

"You see what has to be done?" Prudence asked. "The energizer . . ."

"Stimulator," Bickel said.

"Stimulator," she said. "It has to be part of the AAT's input."

"Slack lines," Bickel muttered. "Sensory modules interlaced and time correlation out of phase. Dual function of signal to compensate for the system's greatly extended spread-out of sense data."

Timberlake looked from one to the other. He felt a sense of dullness lifting from his mind. *Slack lines . . . sensory modules. Symbols!*

Timberlake's memory shot back to their conversation about

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the energizer. "*All the master programs dealing with translation of symbols are monitored through feedback loops linked to the AAT.*" He heard his own voice replaying in his mind.

Symbols! ,

Bickel saw the vitality flowing into Timberlake, said: "Think of the AAT, Tim. Remember what we were saying?"

Timberlake nodded. *The AAT. It received hundreds of duplicates of the same message compressed into the modulated laser burst. It averaged out the blanks and distortions, filtered for noise, compared for probable meaning on the doubtful bits, fed the result into a vocoder and produced it at an output as intelligible sound.*

"It closely approximates what we do when we hear someone say something to us . . . then repeat it to check if we heard correctly," Timberlake said.

"You're all forgetting something," Flattery said.

They turned, saw Flattery at his own action couch, his hand on his own repeater console. A single red light had come alive there.

Flattery stared from Bickel to Prudence to Timberlake, seeing the unnatural brilliance in their eyes. Madness! And the deep color in their faces, their sense of excitement.

"Raj, wait," Bickel said. He spoke soothingly, watching Flattery's hand poised over a key beneath that single red light.

I should've known there'd be another trigger, Bickel thought.

"You know I have to do this, John," Flattery said. And he savored the "Ah-hah!" suspense that charged this moment, the electricity in the air like ozone.

'You have control of the situation," Bickel said. "The least you can do is hear what I have to say."

"We can't turn it loose," Flattery said.

Timberlake swallowed, glanced down at Prudence. *How odd,* he thought, *that we should die so soon after coming alive.*

"How is it, Raj," Bickel asked, "that we can explain more about the unconscious networks of the human body than we can about the conscious?"

"You're wasting time," Flattery said.

"But the thing's dead," Bickel said.

"I have to be sure," Flattery said.

"Raj, you can't," Prudence said. "Think of all those helpless lives down in the hyb tanks. Think of . . ."

"Think of all those helpless lives back on Earth," Flattery said. "What would we turn loose

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on them? John's black box-white box transfer put his life — his entire ancestry into the computer. Don't you see that? Any of you?"

Prudence put a hand to her mouth.

Bickel saw alertness in Flattery, the vital consciousness expressed in every movement, realized the death-conditioning tensions had pushed him over the threshhold into something near full potential. But the new argument Flattery had produced staggered Bickel.

If we restore it . . . awaken it . . . I'd be its unconscious, Bickel thought. *I'd be its emotional monitor, its id, its ego and its ancestors.* He swallowed. *And Raj . . .*

"Raj, don't push that key," Bickel said.

"I must," Flattery said. And he sensed the poignancy of his awareness — this new vitality.

"You don't understand," Bickel said. "That field generator in your cubby. You think there was no feedback from you into the system, but there was. Your voice, your prayers — every gross or subtle reaction went back into the system through its sensors. Whatever religion is to you, that's what it'd be to the Ox. Whatever . . ."

"Whatever religion *was* to me."

And he pushed the key. It clicked, locked.

"How long do we have, Raj?" Timberlake asked.

"Perhaps ten minutes," Flattery said.

"And perhaps more," Bickel said.

"Don't you think we should've tried to limp back to UMB?" Prudence asked. "Awake as we are now, the ship control necessities would've been so much simpler."

"Some fool would be certain to play with this ship — just testing," Flattery said. "And we . . ." He gestured to include all four of them. "This potential we've discovered within ourselves would've been engulfed on earth, smothered, killed." He shrugged. "What are a few minutes or a few years more or less? I had a responsibility . . . and fulfilled it."

"You had a death wish, too," Bickel said.

"That, too," Flattery agreed, recognizing how the deadly impulse had helped project him into this full awareness.

With that realization, Flattery began to glimpse the train of Bickel's cryptic words—their other meaning.

"There were Greeks who said that even the gods must die," Bickel said.

Flattery turned, looked at the big board. It was fully alight now, not a warning telltale showing, every gauge zeroed normal.

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"It's programmed to take us to Tau Ceti," Bickel said.

Flattery began to laugh, almost hysterically. Presently, he stopped, said: "But there's no inhabitable planet at Tau Ceti. You know what all this is, John — a set piece. We know what we are — cell-culture humans! A host gave a bit of himself containing the template of the total, and the *axolotl* tanks did the rest. We were expendables!" He sighed, put down the urge to sink back into the deadly torpor. "They're already growing our replacements, our duplicates, building another *Tin Egg* for the next phase of the Project. Each failure teaches them something back at UMB. They've had a continuous monitor on the computer. When I depressed that key, that also launched a capsule back toward Earth — the complete report."

"Not quite complete," Bickel said.

"The ship is going to take us to Tau Ceti," Timberlake said.

"But the selfdestruction program," Prudence said. And as she spoke, she saw what the others already had seen. The ship held control of its own death. It could die. And this was what had given it life. The impulse welled up into the AAT from the Ox circuits . . . and was repressed, the way humans repressed it. The ship had come to life the way they had — in the midst of death. Death was the background against which life could know itself. Without death — an ending — they were confronted by the infinite-design problem, an impossibility.

All Flattery had done was to provide the AAT — the seat of consciousness — with a super energizer.

"Nothing at Tau Ceti, you're sure?" Bickel asked.

"Planets, but not inhabitable," Flattery said.

A green action light began to glow on the main console.

"No sense going into hyb," Bickel said.

"We are happy," Prudence said. She stared at the green light. "It isn't fully conscious yet — the ship."

"Of course not," Timberlake said, and he thought how deftly she had phrased their emotional state. *I would've said we are filled with joy. But joy has somewhat religious overtones. Prue's way is better.*

Prudence grew aware that Flattery was looking at her. "Why not?" he said.

Yes, why not? she agreed.

But no woman had ever presided at a stranger birth.

She crossed to the main console, switched the computer's au-

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dio pickup into the main input channel.

"You," she said.

She kept her hand on the switch, the new sensitivity of her skin reporting the molecular shift of metal in direct contact.

They waited, knowing the outline of what was happening inside their robotic construction. That one word, internally powered by programmed curiosity and self-preservation directives, was winding its way through the as-yet semi-conscious creation. Preservation — but there were many kinds of preservation, many things to preserve.

But there was only one receptor upon which "You" could impress itself.

Programs were firing, new cross-links being created, comparisons and balances being made.

Abruptly, the board in front of Prue went dead. Every light extinguished, every gauge at dead rest. She waggled the computer switch, got no response. The entire ship began to tremble.

"Is that the self-destruction program?" Bickel asked.

A single word, metallic and harsh, boomed from the vocoder above them: "Negative."

The ship vibration eased, resumed, cut off sharply.

There came a weighted sense of drifting, a profound silence they felt extended throughout the ship.

Again, the vocoder came to life, but softer: "Now, you will see on your screens a lateral view."

The overhead screen and the fore bulkhead screen came alight with the identical scene: a view of a solar system, planets picked out by the telltale red arrows of computer reference.

"Six planets," Flattery whispered. "Notice the pattern — and the sky beyond."

"You recognize it?" Timberlake asked.

"It's the view the probes brought back," Flattery said. "The Tau Ceti system."

"Why would it reproduce the probe view?" Prudence asked.

"Prudence," said the vocoder. "This is not a probe view. These radiations are what I . . . see now around me."

"We're already at Tau Ceti?" Prudence asked. "How can that be? We can't be there!"

"The symbol *there* is an inaccuracy," said the vocoder. "There and here shift according to a polarity dependent upon dimension."

"But we're there!" Prudence said.

"A statement of the obvious may be used to reinforce your awareness," the vocoder said.

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"You were to be conveyed safely to Tau Ceti. You have arrived at Tau Ceti."

"Safely!" Flattery said. "There's no place for us to land."

"An inconvenience, no more."

Every arrow but one on the screen winked out.

"This planet has been prepared for you," said the vocoder.

Bickel glanced sideways at Flattery, saw the psychiatrist-chaplain mopping his brow.

"Something's wrong," Flattery whispered.

"Nothing can be wrong," the vocoder said. "You have but to look around you. You are safe."

The scene on the screens shifted.

"The fourth planet," said the vocoder. "That which is prepared can be preserved."

Flattery gripped Bickel's arm. "Can't you hear it?"

But Bickel was staring at the view on the fore screen — a planet growing larger, filling the screen: a green planet with atmosphere and clouds.

"How did we get here?" Bickel asked. "Is it possible for me to understand?"

"Your understanding is limited," said the vocoder. "Its symbols that you have given me possess strange variance with non-symbolized reality."

"But *you* understand it," Bickel said.

The vocoder seemed to take on a chiding tone: "My understanding transcends all possibilities of this universe. I do not need to *know* this universe because I *possess* this universe as a direct experience."

"Can't you hear it?" Flattery demanded.

Bickel ignored the distraction, remembered that moment in the force of the field generator when he had faltered and fallen back from a transcendental awareness. He had not possessed the capacity. It was a built-in lack.

He could only accept the accomplished fact because the evidence was visible on the viewscreen. They were coming down through clouds — a meadow with trees beyond it and a snow-capped mountain lifted in the background.

"You will find the gravity just a fraction less than that of Earth," said the vocoder. "I am now awakening the colonists in hybernation. Remain where you are until all are awake. You must be together when you make your decision."

His voice rasping in a suddenly dry throat, Bickel glanced up at the vocoder, said: "Decision? What decision?"

"Flattery knows," said the vocoder. "You must decide how you will worship *Me*."

— FRANK HERBERT

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PEEPING TOMMY

Tommy was rich, idle and fond of practical jokes. But he went a bit too far!

by ROBERT F. YOUNG

Tommy Taylor? Oh, he's coming along fine. I visited him just the other day. Had a long talk with him. He'll be as good as new again as soon as they take the bandages off. Funny, how an expression can be born for the wrong reason, and last for centuries . . .

He quit the Club, you know. Said he didn't want any part of it any more. As though the Club had anything to do with his misfortune! To tell the truth, we were dubious about letting him join in the first place. We're a pretty serious bunch, you know, us fellows at the Yore. Each of us is a specialist in his own right and not ordinarily inclined to bend elbows with a layman, even a filthy-rich layman who can speak six different languages. But, as Hogglewaite (he specializes in

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Permian rocks) said, time-travel costs like hell and we needed the money.

And Tommy didn't mind. Like most playboy-inheritors of late-twentieth century family fortunes, he throws $1,000 bills to the winds like rain. Oh, we're going to miss him all right. The more so because, contrary to our expectations, he never played a single one of his practical jokes on us.

You didn't know he was a practical-joke enthusiast? You can't know very much about him then. Some men — like myself, — live to tape ancient battles. Some men — old Hogglewaite, for instance — live to collect Permian rocks. And some men — yourself, for instance — live to pick the brains of people like me while we're on our coffee break so they can write technical articles for the trade journals. But Tommy Taylor lives to play practical jokes. Or at least that was his purpose in life up until a few weeks ago.

At first, he was content to play them on people in the present, and then it occurred to him how much more fun — and how much easier — it would be to play them on people in the past. That was when he joined the Yore Club and took out a two-year lease on one of our time-bikes. (The lease has another two months.)

Up until the time this awful thing happened to him, he was gone most of the time, pedaling back to every age you can think of, and playing practical jokes on this past person and that. I'm not defending him when I say that there are far worse ways for a man to work off his frustrations, and I'm not being callous either. No one can do anything in the past that, in one sense, he hasn't done already . . . which means that if he hasn't already done it, he won't, and that if he has, he will, whether he wants to or not. Tommy was merely fulfilling his destiny — that's all. And basically that's all anyone who ever pedals back to the past is doing.

Anyway, most of Tommy's capers were little more than mischievous pranks, and did no real harm to anyone. Take the time he went back to Charlestown of the night of April 18th, 1775, and hid Paul Revere's horse. Poor Paul was half out of his mind till he found it, but no permanent damage was done. He still made his historic ride. And then there was the time Tommy put invisible ink in the Continental Congress' inkwell on the eve of the signing of the Declaration of Independence. John Hancock was fit to be tied — but again, no permanent damage was done. The ruse was discovered (though

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not its author), the inkwell was emptied and refilled, and the historic document was signed.

In addition to being a master of six languages, Tommy Taylor was a master of disguise. If you don't believe it, take a look at Brueghel the Elder's "The Peasant Wedding" sometime. A good reproduction will do. That's right — Tommy's in it. He's the musician in Red (did I mention he's an accomplished musician—well, he is)—the one who has the hungry look in his eyes and who needs a shave. Brueghl recorded him perfectly. Photographically, almost. Tommy loves to go to weddings — or at least he did. Weddings provide ideal situations for practical jokes.

Some of his more malicious capers, though, I can't quite go along with, even though I realize that basically he had no free will in any of the things he did. Take the innumerable times he told Balzac's creditors where Balzac was hiding, for instance. Or the time when he intercepted the one and only letter that Dante wrote to Beatrice (I guess we have Tommy to thank for *The Divine Comedy*). And then there was the time he burned Carlyle's first draft of *The French Revolution* after John Stuart Mill finished reading it. It was the only copy poor Carlyle had, and he had to do the whole thing over again from memory. Mill blamed his housemaid, and so does history; but we at the Yore know better.

Probably the most fiendish joke Tommy ever played, though, was the one he played on King Solomon. On the eve of the Queen of Sheba's arrival in Jerusalem, Tommy got a job in the royal kitchen, and everyday for the duration of the Queen's visit he slipped six grams of anti-aphrodisiac powder into the king's daily cup of goat's milk. I imagine it would come as something of a shock to Biblical scholars to know that the *Song of Songs* is nothing more than a wish-fulfillment reverie.

But Tommy's activities in the past weren't limited to playing jokes. Not only was he a practical joker, he was also a Peeping Tom.

The one is a natural outgrowth of the other, you see. You can be present at the denouement of most jokes, but not all of them. Some of them you have to view from the outside, so to speak.

You've probably guessed the truth by now, but I'll unveil it anyway: Tommy Taylor was the "tailor" who peeped — and got blinded for it. But the incident didn't happen quite the way the legend would have you believe. Legends are about as historically

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accurate as old Biblical movies.

Tommy never dreamed the Coventry caper would backfire on him. The analogy between his surname and the occupation of the legendary victim failed to register on his mind, you see, and he took it for granted that he and the famous tailor were two different people. So, figuring that he was immune from harm, he costumed himself to conform to the period, pedaled back to ancient Coventry, hid his time-bike, and, using his own name, rented a room whose single window faced the narrowest street in town. Then he sat back to wait till Lady Godiva came riding by on her white horse. When she did, he threw open the shutters and looked — and she almost clawed his eyes out.

Now wait a minute. Don't jump to conclusions. I didn't say she tried to claw his eyes out because he looked. I know as well as you do that she probably *wanted* someone to look. But Tommy Taylor, remember, was a practical joker first and a Peeping Tom second. Sure, he looked —

But he also leaned out the window and, with a long pair of barber's shears, cut her hair off.

— ROBERT F. YOUNG

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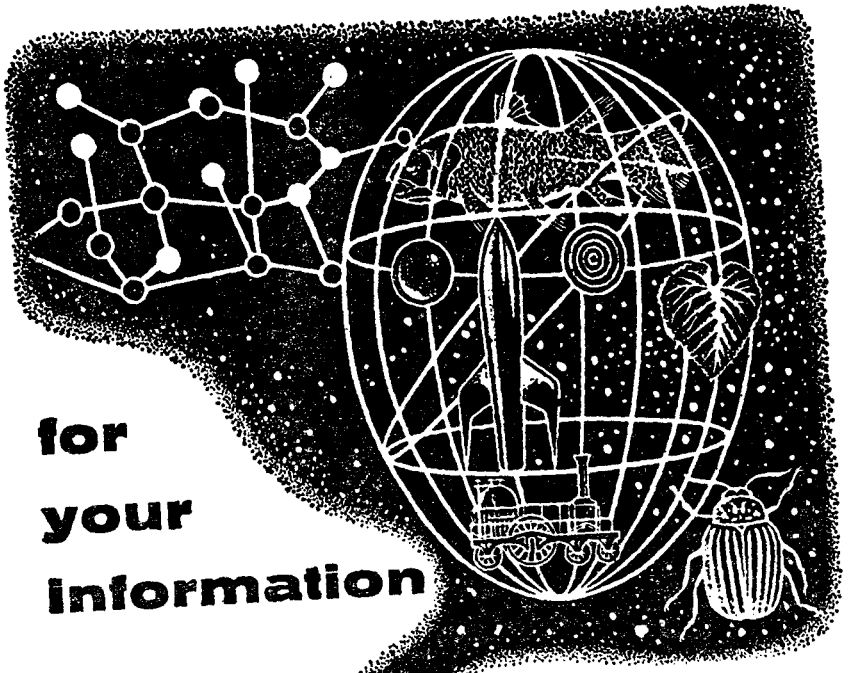

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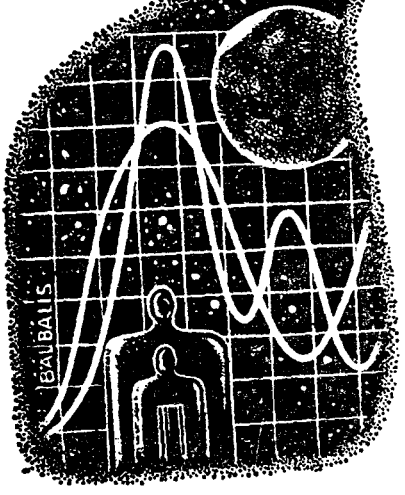

THE GALACTIC GIANTS

Moons go around the earths
the earths go 'round the suns
and all the hosts of suns
circle a giant sun.

F. G. Klopstock (1724-1803)

When the German poet Friedrich Gottlieb Klopstock wrote the ode from which these lines are taken, he did not indulge in po-

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etic imagination. He just wrote down what many astronomers and philosophers of his time believed to be true. Klopstock's direct source was probably Immanuel Kant's *General Natural History and Theory of the Heavens,* published for the first time in 1755.

Immanuel Kant — he happened to be born in the same year as Klopstock and survived him by one year — not only believed in a "central sun" of the Milky Way, he even thought that we could see it in the sky. Kant's candidate for the role of the "central sun" was Sirius, the brightest star of the northern sky. Kant's reasoning, as usual, was logical and clear.

Since the Milky Way does not have the same width all the way around but looks wider in the area between Cygnus and Sagittarius, it follows that our sun is not in the center, but is closer to this section of the Milky Way. Sirius, on the other hand, is in a position that could be the center; and it is also the brightest star. Of course, in order to be the central sun, it would have to be larger by far than any other star. Shouldn't this fact be immediately apparent to the eye? Kant explained why it doesn't have to be so obvious: "even if it (Sirius) were 10,000 times as large as our sun, the apparent brightness and size would be the same if it were a hundred times farther away." Since the distance to Sirius, or to any other star, was not known at the time, nobody could argue with the supposition that Sirius might be the central sun of the Milky Way.

For a full century Kant's opinion was quoted as something that was probably correct even though it could neither be proved nor disproved. But around the middle of the nineteenth century the distance to Sirius had been determined — after a few corrections — as being only 8.7 light years. This calculation enabled astronomers to make fairly correct guesses about the size of Sirius. It was larger than our sun, but not much larger, and many times as luminous. In short: Sirius could not be the central sun, but that did not mean that there was no central sun.

By 1880, say, the idea of a central sun had been, as somebody phrased it, "reluctantly abandoned." Another forty years later it became clear that the Milky Way galaxy was about six times larger than had been assumed, since the galactic center and everything "behind" it — from our point of view — is hidden by enormous clouds of cosmic dust and gas. At that moment the idea of a central sun

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could have been revived on the grounds that since we cannot see the galactic center we cannot say whether there is a central sun or not. But the general progress of astronomical research prevented this argument from being uttered. It was already clear that certain objects in the sky were other galaxies and while many of them showed a definite nucleus where suns are more densely packed than in their arms, none showed a central sun.

Nobody is looking for a central sun of overwhelming mass and gravitational might anymore, but a related question is still very much alive. Our galaxy is an aggregation of perhaps 100,000 *million* stars of varying sizes. One of them must be the largest. Which one is it and how large is it?

Slowly now, we cannot answer that question because only about one sixth of our galaxy can be directly observed. Alright then, which is the largest star in the observable portion of our galaxy?

Well, yes — now that is an interesting question. Too bad that it cannot be answered without first asking a few counter-questions. That word "largest" may be good enough when it comes to light bulbs, cigars or elephants. It is not good enough, meaning precise enough, when it comes to stars. Do you mean the brightest star, the one with the greatest luminosity? Or do you mean the star with the greatest mass, the one that would weigh most if it could be placed on a scale? Or do you mean the star with the greatest volume, the one that occupies more cubic miles of space than any other? These are three different classifications and they do not go together.

Since stars are by definition self-luminous objects we'll look for brilliance first. As seen from earth, the crown goes to Sirius, it sends us more than twice as much light as any other star we can see.

But that only means that Sirius is the brightest star in our sky, it does not mean that it is the brightest star in the observable portion of the galaxy. It is self-evident that a much brighter star which is also much farther away will look dimmer to our eyes. To get rid of the difficulty caused by the very considerable differences in distances a simplifying convention had to be introduced. It consisted of agreeing on a standard distance; the distance chosen was ten parsecs or 32.59 light years. The magnitude of a star is described as if it were that distance away, and it is called the absolute magnitude. The magnitude that we do see and which makes Sirius the brightest star

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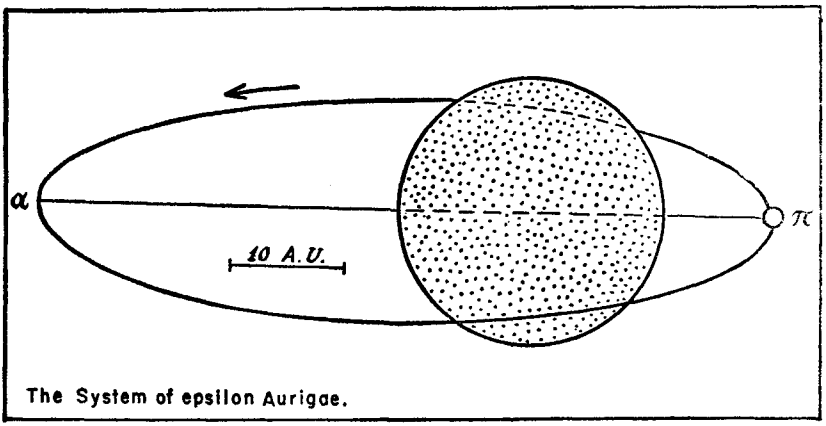

Figure 1. The two components of *epsilon* Aurigae, drawn to scale, in the position they occupied in 1951. The short line labeled 10 A.U. indicates a distance of 10 astronomical units or 930 million miles.

in our sky is the apparent magnitude.

Just to clear up the terminology it has to be added that two other kinds of magnitude are mentioned in astronomical literature. One is the visual magnitude which is the same as the apparent magnitude for visual observations. But stars that radiate a great deal of blue and violet light look brighter on the photographic plate than they do to the eye and here, of course, the term photographic magnitude is used.

For our discussion the photographic magnitude can be neglected. We will deal only with the "apparent (visual) magnitude" and mainly with the "absolute magnitude" the visual magnitude as it would be if seen from a distance of 10 parsecs. If you deal with absolute magnitudes only the relative luminosities of the stars can be expressed simply in terms of the luminosity of our sun. A star that is as luminous as our sun, no matter how faint it looks because of a long distance, would be said to have the luminosity "1".

But let us look at a few examples.

Sirius has a luminosity of 26, that is to say that it is 26 times as bright as the sun. The nearest other star, *alpha* Centauri happens to be a binary, its brighter component, *alpha* Centauri A has a luminosity of 1.1, it is just a little brighter than our sun. The other component, *alpha* Centauri B, is much dimmer, its luminosi-

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ty is only 0.2. Vega's luminosity is 50, that of Capella is 150, and that of Aldebaran is 90. The star *beta* Centauri, second brightest star in the constellation of the Centaur, has a surprisingly great luminosity, namely 3,000; but unlike *alpha* Centauri *beta* Centauri is 300 light years or 91 parsecs distant. Deneb, about 200 parsecs away, has a luminosity of about 10,000, Rigel, about 166 parsecs distant, has a luminosity of 18,000, and Canopus, 200 parsecs away, has a luminosity of 80,000. If the earth were suddenly placed in an orbit 100 million miles from Canopus, all land life on the hemisphere pointing at Canopus would be killed instantly and the oceans would have boiled away before the earth had time to rotate once on its axis.

A close runner-up of Canopus is *ypsilon* Sagittarii. To the naked eye it is just a fourth magnitude star at an estimated distance of about 9,000 light years or 3,200 parsecs. Its luminosity is somewhere between 50,000 and 70,000 times that of our sun. Naturally such estimates cannot be precise; we simply cannot know how much of the light is absorbed by so-called "empty" space during a 9,000 year journey. It is entirely possible that *ypsilon* Sagittarii has the same luminosity as Canopus. At any event these two, at the moment, share first place as regards true luminosity among the stars in the observable region of our galaxy.

Though this survey is restricted to the one sixth of our own galaxy that can be observed visually, one exception has to be made.

Our galaxy has two satellite galaxies collectively known as the Magellanic Clouds. The larger of the Magellanic Clouds contains numerous clusters of stars, often imbedded in nebulosities. Many hot and bright blue-white giants of the type of Rigel are present. It is generally assumed that Rigel type giants are the result of a recent "feeding" with cosmic dust due to a passage through a dust cloud. Since space inside the Greater Magellanic Cloud is quite dusty, all this goes together quite well. But in a cluster of the cloud which is labelled NGC 1910 there is a supergiant surpassing anything that we can see in our section of the galaxy. It is the star called S Doradus. Because of the distance of 160,000 light years S Doradus is not visible to the naked eye, yet it is the must luminous star known.

It is a variable, with an absolute luminosity ranging from 8.2 at minimum to 9.4 at maximum. This means that its average luminosity is *one million times* that of our sun! If it is a single star its diameter might be as

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large as 200 million miles. But it may be a binary. Sergei Gaposchkin has suggested that it might be a system of two blue-white supergiants eclipsing each other during a 40-year period. It has also been suggested that S Doradus was, a comparatively short time ago, a double supernova which is now fading.

If S Doradus is a single star and if it follows the rules derived from our "neighborhood stars", its lifetime, at the present rate of energy expenditure, would be only 3,000 years.

As far as the more luminous objects that have been dubbed "quasars" — a contraction of the original designation "quasi-stellar objects" — are concerned, I'm going to postpone any discussion until the time we know something about them.

Determining the surface temperature of a star is relatively easy with modern instrumentation.

Measuring a star's apparent magnitude and calculating its true luminosity does not present any special difficulties and if all these factors are known it is easy to calculate the surface area of a star and to derive its diameter from the surface area.

But while every star that throws radiation into space advertises its temperature, composition and size, very many stars succeed in retaining a secret, namely their mass and density. As a matter of fact there is no way of determining the mass of a *single* star. Only if the star in question is a component of a binary — or a multiple system — can we find its mass by studying the orbital paths followed by the two stars. Of course in quite a number of cases close guesses can be made. If we have one star where the mass could be determined because it is a component of a binary and we then find another star of the same absolute magnitude and belonging to the same (spectral) class, it is reasonable to assume that this latter star's mass will be about the same as that of the measured star.

Keeping the restriction in mind that, generally speaking, we can know only the masses of binaries we can now ask about the most massive star known.

The answer is: H.D. 47129 in the constellation Monoceros. The letters H. D. stand for "Henry Draper Catalogue", published by Harvard University during the years immediately following the first World War. But H.D. 47129 has a name, too. It is known as Plaskett's Star, after J. S. Plaskett, the director of the Dominion Astrophysical Observatory at Victoria, British Columbia, who

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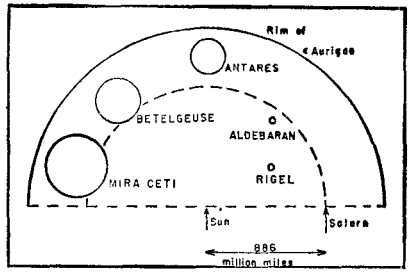
proved that this star was a binary with an orbital period of 14.4 days. The combined mass of the binary turned out to be 180 times the mass of our sun. Both components seem to share this mass equally, or very nearly so, so that each component of Plaskett's star has a mass of 90 times that of the sun. Both also belong to the same spectral type (O_8) and since the density of stars of that spectral type is usually only about 10 per cent of the sun's density they must be large in size too.

If Sir Arthur Eddington is right, the two components of this binary are about as massive as a star can be. He found that a star of a mass greater than about 100 solar masses cannot exist. When that mass is reached the radiation pressure inside the star becomes stronger than the gravitational forces that hold the star together. A star of, say, 150 solar masses would be blown apart by its own radiation pressure. So far all known examples conform to Sir Arthur Eddington's calculation, even the largest stars have masses far below the two heavyweights that form Plaskett's Star.

And that brings us to the stars with the greatest volume, collectively known as the Red Giants: Algol, Aldebaran and Arcturus. Algol is a binary consisting



THE LARGEST KNOWN STARS

Figure 2. Rigel is a Blue-white Giant, Aldebaran a Red Giant, Antares, Betelgeuse and Mira Ceti are Red Supergiants, and *epsilon* Aurigae is in a class by itself which has no name yet. If the sun were in the center of *epsilon* Aurigae, the planet Saturn would move along the broken line.

of two Red Giants of nearly identical mass and size. Their diameters are 15 times that of the sun, but their masses are only 4 solar masses each. Aldebaran and Arcturus are singles with diameters on the order of 30 solar diameters but their estimated masses are also just 4 solar masses. Antares, Betelgeuse and Mira Ceti are classed as Red Supergiants; their diameters, according to the late Otto Struve, are 300, 400 and 500 solar diameters. But the mass of Antares is estimated as only 10 solar masses, Betelgeuse probably weighs 15 times as much as our sun and Mira Ceti not much more.

But the very largest star of the observable portion of our galaxy is one that has literally never

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been seen. It is the supergiant *epsilon* Aurigae, with a diameter 3,000 times as large as that of the sun — which, incidentally, is 860,000 miles. But if it has never been seen, how do we know that it exists and on what authority can its diameter be given? The answer can almost be guessed: because it is a component of a binary.

The other component of this binary is visible, of course, and the designation *epsilon* Aurigae really belongs to this visible component. It was in 1821 when a German Lutheran pastor by the name of Fritsch, who lived in the old city of Quedlinburg, noticed that it was a variable star. Not realizing that an important discovery was within grasp he did not follow up on his observation and it was Friedrich Wilhelm Argelander in Bonn who, in 1848, made good visual observations of *epsilon* Aurigae at minimum luminosity. It became clear that *epsilon* Aurigae was a so-called eclipsing variable, which means a star that does not actually change its luminosity periodically as the true variables do. The apparent change is due to the fact that a less luminous star moves in front of its more luminous component, thereby making it look dimmer. Argelander noticed two facts: the orbital period was unusually long and the second component was invisible. As for the latter he probably thought that later and more powerful telescopes would show it.

Other eclipses took place in 1875, 1902 and 1929, all well observed. The last eclipse was in 1955 with the next one due in 1982. The period is 27.1 years, the longest period for an eclipsing binary that is known. Even the eclipse itself is of impressive length; in 1955 it began on June 5. The light of the visible component diminished steadily for 192 days and reached its minimum during the second week of December of that year. It then stayed at minimum for 330 days and needed another 192 days to return to normal, a total eclipse duration of 714 days, or two years minus two weeks and two days. But all the time the smaller component remains visible, shining through the very tenuous large star!

To speak of the luminous member of *epsilon* Aurigae as the "smaller component" is justified only because the term is used in comparison with the larger component. The smaller component is itself a supergiant with a diameter of 250-300 times that of the sun and a mass of about 40 solar masses.

The mass of the large star, ten times the diameter of the smaller

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companion, is also about 40 solar masses, possibly somewhat less. This has the result that the density is the lowest known of any star, if you took one million cubic miles of it and compressed it into one cubic mile you would have a substance of the same density as our air at sea level. The surface temperature is at best 1,000° centigrade (1,832° Fahrenheit) but probably less. It is too cool to be luminous. But, of course, at its center the density and the temperature must be higher. Its core should be luminous but we cannot see it; what little light there is is drowned out by the glare of the bright star. The distance to *epsilon* Aurigae can only be estimated, but is believed to be on the order of 3,000 light years.

It has often been said that thoroughness is the cloak of the philosopher and the scientist. Without it he feels naked and does not like to appear in public. Hence a discussion of the galactic giants would be incomplete without at least one quick glance at the galactic midgets.

Just as the question about the largest star has more than one answer, the question about the smallest star does too. And again it is a case of whether "small" is meant to refer to mass, volume or luminosity.

For years the star L 886-6 in Monoceros, discovered by Dr. William J. Luyten, was cited as being the star with the smallest volume. It would need 60,000 such stars to produce as much light as our sun does. The calculated diameter is 2,500 miles, only about 340 miles more than the diameter of our moon. But L 886-6 is a White Dwarf, its mass is 1.4 solar masses and the density of its matter is 55 million times the density of water.

But in 1962 Dr. Luyten came up with an even smaller White Dwarf, LP 327-186 in Taurus with a diameter of only about 1,000 miles. Its density must be about four times that of the density of L 886-6.

The faintest star known (not a White Dwarf) has a brightness of only one millionth that of the sun. It is a companion to another faint star, registered as B.D. + 4° 4048[1]. It was discovered by Dr. G. Van Biesbroek and was found to have an absolute magnitude of 19 in red light, three magnitudes fainter than the oft quoted faint star Wolf 359.

The lightest known star was announced by Dr. Peter van de Camp in 1944. Its designation is Ross 614-B, its absolute magnitude is 17, its luminosity is only

1) The letters B.D. stand for Argelander's **Bonner Durchmusterung**, the "Bonn (stellar) Census."

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1/70,000th of the sun and the mass is 1/12th of the mass of the sun.

The Original Inventor of Recording Tape.

Several years ago I devoted a section of my column to a discussion of the fact that all the materials needed for building a large liquid fuel rocket existed in 1906. I also pointed out that most of the sub-assemblies, such as centrifugal pumps, pressure bottles for gas with which to run gyroscopes and so forth were in existence at the time.

Even the idea of large liquid fuel rockets had been voiced at the time. What was missing was a synthesis of the existing pieces of knowledge and hardware.

Last year I repeated the story during a lecture to an engineering society in the Los Angeles area and during the social hour that followed the lecture more than one engineer, engaged in space work, let out thoughtful moans which could be vocalized as: "What do we have now that could be put together for something revolutionary if only somebody had the necessary vision for a synthesis?"

I regret sincerely that I cannot answer this question — if I could I'd get myself a few patents and tell industry to negotiate with my attorney. But I can tell a story that illustrates the opposite case, that of a man who had vision and the right idea but who could not do anything with it because a needed invention or two had not yet been made. His name was Oberlin Smith and he should be regarded as the original inventor of recording tape, useful from kindergarten to orbiting satellites.

The original publication by Oberlin Smith took place in the long defunct journel *The Electrical World*, issue of September 8, 1888. His opening paragraph read: "There being nowadays throughout the scientific world great activity of thought regarding listening and talking machines (both Alexander Graham Bell and Thomas Alva Edison had obtained their patents for the telephone and for the phonograph about a decade earlier, in 1877) the readers of *The Electrical World* may be interested in a description of two or three possible methods of making a phonograph which the writer contrived some years ago, but which were laid aside and never brought to completion on account of a press of other work."

The first of Smith's suggestions was a possible improvement of Edison's phonograph by inscribing the sound not on tinfoil (as Edison did) but on a "thin ribbon of iron, steel or other sub-

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stance capable of being temporarily softened by heat." The ribbon was to have a width of about 1/30th of an inch and a probable thickness of 1/200th of an inch. The idea was to soften the ribbon by a heat lamp just before it reached the inscribing needle and to have the distance between recording needle and receiving reel long enough so that the ribbon would be hard again when wound on the reel. Looking back at this suggestion from the vantage point provided by the three quarters of a century that have passed, one can say that this probably would not have worked out well with a metallic ribbon but that Mr. Smith might have been quite successful if thermo-setting plastics (or even ordinary thermoplastics) had existed in his time.

But it is the next suggestion that makes Oberlin Smith the original inventor of the recording tape. He proceeded to point out that an "all-electric method" is likely to be superior to a mechanical method. He wanted to pass a "cord" through a coil connected with a microphone so that "the cord becomes, so to speak, a series of short magnets grouped into alternate swellings and attenuations of magnetism."

"The cord," he continued, "therefore contains a perfect record of the sound, far more delicate than the indentations in the tinfoil of the mechanical phonograph. The probable construction of the cord would be a cotton, silk or other thread, among whose fibres would be spun (or otherwise mixed) hard steel dust, or short clippings of very fine steel wire, hardened. Each piece would, of course, became a complete magnet. Other forms of the cord might be a brass, lead or other wire or ribbon through which the steel dust was mixed in melting, being hardened afterwards in the case of brass or any metal with a high melting point. Another (but too expensive), form would be a chain with each link a magnet; or, if the magnets affected each other too much when in contact, each alternate link could be of non-magnetic material."

Oberlin Smith did not think that the idea of a chain, already discarded because of its probable high price, was as good as the idea of dust magnets imbedded in a thread or ribbon of non-metallic material. And he mentioned, but discarded, the idea that it might be possible to use just a steel wire, because he doubted that the steel wire "would divide itself up properly into a number of short magnets. The magnetic influence would be distributed along the wire in a

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most totally depraved way, with nodal points just where they were not wanted."

The reason why Smith did not follow up on his own ideas was not just the "press of other work" as he had cited in the beginning. He had run into too many practical difficulties. He had developed a machine for spinning dust into a cotton thread, but had been unable to harden steel dust because of oxidation taking place in the process. He had chopped up steel wire and found that a piece of wire had to be three or four times as long as its diameter, or else the small pieces would not become magnets, at least in his own experiments. He had tried to find information on very small magnets in contemporary books, but such information either did not exist, or else it had not been published in English. He had approached other researchers with his problem, admitting his ignorance, but "had found an equal amount of ignorance in several well-known electricians."

Again, from the vantage point of three quarters of a century later, it is easy to see what went wrong. Oberlin Smith had what he considered to be an interesting and possibly workable idea. But it was far more than that, it was a project that would require an extensive research program of several thousand scientific man hours. Realizing this to some extent, he had decided to publish his ideas, "hoping that some of the numerous experimenters now working in this field may find a germ of good from which something useful may grow."

The other experimenters did not pay any known attention to Smith's "germ", either because they realized the magnitude of the job to be done or — more probable — because they were busy with projects of their own.

The first man who actually built a recording device along the lines suggested by Smith was the Danish inventor Valdemar Poulson who probably never saw Smith's article. One of the reasons for saying so is that Poulson did use a steel wire. His instrument was called the "Telegraphon" and it was one of the many attractions of the Paris Exposition of 1900. Among the important men of the time who listened to the inventor's explanation was old Emperor Franz Josef of Austria who then said into the microphone: "This new invention is most interesting to me and I thank you very much for its demonstration," — and then listened to his own voice. In all probability Franz Josef was as surprised at the sound of his own

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voice as everybody else who hears it for the first time. But in spite of its public success at the Exposition the "Telegraphon" remained a one-time attempt, possibly because the phonograph was reasonably well established.

Well, where and when did the recording tape of today begin? It began with the German patent No. 500,900, granted to one Fritz Pfleumer of Dresden in 1928 who claimed the invention of recording sound on paper ticker tape that had been covered with iron dust. He actually built an apparatus for demonstration, but the first results were hardly acceptable. He offered his invention, among others, to the A.E.G. (*Allgemeine Electricitats-Gesellschaft*), the German counterpart of General Electric. The research chiefs of the A.E.G. reacted precisely as Oberlin Smith had hoped his contemporaries would react. They decided that this was a useful idea, but totally useless without lots of developmental work.

One of the things that Mr. Pfleumer's tape did was to produce cracking noises at random intervals. They were finally traced to almost miscroscopic holes in the paper tape. Paper manufacturers had never been asked to produce thin paper that did not have miscroscopic holes and when confronted with such a request said two things: (1) that thin paper apparently was bound to have such holes and that there was nothing they could do about it; (2) if the elimination of such holes was so important, why didn't A.E.G. glue two tapes together? Each tape would have holes, but that the holes would match was most unlikely.

Of course that was correct, but paper tape just was not strong enough and A.E.G. threw the project into the lap of a chemical plant in Ludwigshafen: "Find something that behaves like paper in every physical aspect but is stronger and, if possible, fireproof." That was the request. The chemists of the company felt that the final request — namely that the tape should be fireproof — was unreasonable. They ignored it and, in 1932, began to experiment with tapes of cellulose acetate. Two years later they had something that could be publicly demonstrated, the occasion was a Radio Exposition in Berlin in 1934. By 1939 the factory produced over 16 million feet of recording tape.

Ten years after the first public demonstration a new material was found, namely polyvinylchloride. And that was the recording tape we now know, based on a principle Oberlin Smith had thought up back in 1888.

— WILLY LEY

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Please State My Business

by MICHAEL KURLAND

What marvelous gadgets! They worked every time — specially when you didn't want them to!

Miss Appleton, secretary and receptionist to the firm of Doublas, Rogan and Stretch, Consultants, was leaning back in her chair behind the desk in the outer office, polishing her bright red nails when the door to the broom closet opened and a man stepped out. Adjusting his purple and yellow zebra-striped suit, he strode to the desk and leered at Miss Appleton. She hurriedly sat up in the chair and pulled down her skirt.

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"Yes?" she almost stammered.

"State my business," the man demanded.

Miss Appleton recoiled. "What?"

"State my business," the man in the zebra-striped suit declared, "I must."

"You just came out of the broom closet," Miss Appleton said firmly.

"Very interesting," the zebra-man affirmed.

"But there wasn't anyone in the broom closet," Miss Appleton said, trying not to scream.

"Not before," the man confirmed, "after."

"What?" Miss Appleton said, repeating herself.

"Of course," the man said. "Obvious. Wrong tense. Not in before. In after. I," he announced proudly, "am forty-four."

"Oh," Miss Appleton said weakly. "Very interesting."

"Now round bluebird conversation developing is," the zebra-striped man informed her. "State my business I must. Of importance to your firmly is. Of course. I am forty-four. Accredited representative."

Miss Appleton fought down a rising wave of hysteria. Doublas, Rogan and Stretch, she reminded herself, did not employ her because of her beauty alone. Her intelligence and common sense, as Mister Stretch had told her in his apartment, were important assets of the firm. Valuable business had been brought in by a lot of very peculiar people. Her job was to pacify them; not to reason why, or how they had come out of the broom closet.

"Whom do you wish to see?" she asked, with her sweetest smile.

"Ah, better is. Down to business we getting are. Proper person you must direct me to. I am representative (accredited), you are consultant. I am forty-four, you twenty-three are."

"Twenty-two," Miss Appleton corrected without thinking.

"For sure?" The man looked surprised. "Of no great importance is, but shocking mechanism error."

Miss Appleton was losing the thread of the conversation. She fell back on: "Whom did you say you wished to talk to?"

"He who can help me, my position considering."

That would be a psychiatrist, Miss Appleton thought, staring at the broad purple stripes on the yellow suit—or were they yellow stripes on a . . .

"You like garment?" the man asked, noting her gaze and pirouetting gracefully in front of the desk. "Conservative, comforting and climactic is."

"V-very attractive," she said.

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"Give me your name, and I'll see if Mr. Stretch will see you."

"Done," the zebra-man said gaily. "My name yours is." He made a grandiloquent gesture.

"Yes," she said desperately, "but what is the name?"

"Ah," zebra-stripe said, "Shakespeare. Famous quotation is. How fine that attracting woman like you should also so intelligent be." He pulled a small white rectangle from a pocket in his sleeve and handed it to her. It was a business card. *Praz,* it said, *Accredited Representative, Moibly Cre., Traders Down the Years.* In the lower right hand corner of the card it said *44th.*

Miss Appleton picked up the phone and pressed the inter-office buzzer. "Mister Stretch? There's a Mister Praz out here to see you. From Moibly Cray."

"Cre.," the zebra-man corrected her, "short E is."

"Cre.," she said into the phone.

"What's that?" Stretch's hoarse voice came over the wire. "Well, look here, Cinderella, keep him out there 'till I get my tie on. I'll buzz you in a minute, then send him in."

"Yes, sir." She hung up. "Mister Stretch will see you in a minute," she informed Praz.

"Fine is," he said. He started advancing around the desk. "Now time for gathering rosebuds in May is. Historical quotation of great age." He lunged. Miss Appleton ducked. The chair shot out from under her and sped across the room, leaving Miss Appleton on the floor. Praz settled on top of her. "Veritable rosebud," he murmured in her ear. He kissed her passionately. She tried to push him away, and idiotically found herself thinking that his suit felt very warm to the touch. He kissed her again. He seems to have had a lot of practice, she reflected. The buzzer sounded.

"Mister Stretch will see you now," she said.

"Ah," he said, jumping up. "Business is. I shall return. Quotation." He slid something out of an inside pocket and put it on the desk. "Present for you is," he said.

Miss Appleton got up off the floor and smoothed her skirt. She looked at the object on the desk. It looked like an engraved ivory box for a long harmonica.

"For you," Praz said, "Martian Dream is." He opened the door to the inner office, and went inside. Miss Appleton leaned over the box and opened it. A thin stream of water hit her in the nose.

George Stretch had been schooled for many years in the art of keeping his face expressionless. If the diagonal

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purple and yellow striping of his visitor's suit startled him, he didn't show it. As Praz approached the desk, he stood up and extended his hand. "Mister Praz," he said, "welcome."

Praz examined the outstretched arm critically. "Why you bite your nails do?" he asked.

Stretch jerked his arm back as if it were confronted by a scorpion about to strike. "Ha ha," he said, "hum." He sat down. Indicating a chair by his desk, he said, "Take a seat."

"Do not wish," his visitor told him, "however, will borrow." Praz dropped into the indicated chair. "You business consultant are?" he asked.

"That's what our card says."

"Interesting. You able to handle and spread new produce are?"

Stretch leaned back in his chair. "Well now, that's not our usual line, but I'm sure something can be worked out."

"Of excellence is." Praz took what looked like a handle from his jacket pocket. He shook it, and a large briefcase descended from it, and remained attached. "Uew produce to show you."

Stretch kept a very tight grip on the sides of his chair, and worked at keeping his face expressionless. He almost succeeded. "Where," he grated, "where are you from?"

Praz saw Stretch staring at the case, and understood. "Of sorrow am," he said, "of apologies. You not told were. Of course. I am forty-four."

"I don't care how old you are; how did you do that trick with the briefcase?"

"Illumination comes. Semantic difficulty is. Forty-four not years of age, it century. I temporal representative of firmly in forty-fourth numbered century am."

"You mean, you're from the future?"

"I mean that."

Stretch stopped to think. He prided himself on his ability to adjust to unfamiliar situations, but he also prided himself on his ability to avoid being hoaxed. "That would explain the briefcase," he said. "But, before we settle down to business, can you offer any further proof?"

"Ah! You afraid that I a confidential man might be are."

Stretch sorted the sentence out. "That's right," he admitted.

"Attached-case not sufficient proof. Of course. Contents of case, however, should convincing be."

"Attached-case?"

"To handle," Praz explained. He laid the case on the desk and opened it. It was divided into a number of closed compartments. "I show you varied produce, and, at same time, convince you of genuineness of self will." He

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opened the first compartment, and took out a small silver disk. "Matter duplicator is," he announced.

"A matter duplicator? That would convince me." Stretch squinted at the tiny object glittering in Praz's hand and then fished in his wallet for a dollar bill. "Here," he said, extending it, "let's see you duplicate this."

"Unable," Praz said, not taking the bill. "Disk only duplicate pattern imposed in manufacture will."

"Oh," Stretch said. "Well, what does this one duplicate?"

"Small pastries," Praz told him, "in shapes of various animals. He shook the disk, grabbing the small object that came out, and handed it to Stretch. "Taste," he said.

Stretch examined the object. It was a small, perfectly formed goose, with its wings outstretched as though in flight. He weighed it tentatively in his hand and then bit off the right wing. "Animal crackers," he said, munching on the morsel, "but good, very good."

When Stretch finished the goose, Praz shook another object out of the disk and handed it over. Stretch took it, but almost dropped it when he got a close look. The beast reproduced in miniature exceeded in horror of appearance the best attempts of the Hollywood monster-makers. Vicious claws terminated each of the monster's six arms; long, curved fangs protruded from the obscenely grinning mouth; and tentacles grouped about the head like a nightmare Medusa.

"What on Earth is *that*?" Stretch demanded.

"Not of Earth," Praz explained. "Andromeda from. Intelligent indigenous life form is. Excellent pets for pre-school children makes."

"Oh." Stretch carefully put the beast aside. "What other products do you have to show me?"

"Matter duplicator not great success is? Perhaps this more impressive will be." Praz removed a small black object from another compartment in his attached-case and threw it in the general direction of the wall. It landed, clung for a second, and then scuttled into a corner near the ceiling.

Stretch glared at the formless object. It glared back with one small red eye. "What is it?" Stretch asked, averting his gaze.

"Fire extincter is. Autonomous. If you flint-and-steel have, I demonstrate."

Stretch pulled out his lighter and handed it to Praz, who examined it intently for a minute and then, with a twist of his finger, released the spring that held the flint in. The spring went

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bouncing around the room, and Praz dived after it yelling what sounded like "up beast!"

Praz retrieved the spring from under the desk and stood up. He started pulling the cotton stuffing out of the lighter and arranging it in a little mound of tufts on one corner of the desk.

Stretch controlled himself. "What are you doing?" he yelled softly.

"Preparing kindling, starting fire for."

"Won't a match do?"

"Match?"

"Yes, match." Stretch pulled a pack of matches out of his pocket and struck one in demonstration. The shapeless black beast on the wall scurried over to a point near the match, and neatly spat a white powder on it. The match went out.

"Will do," Praz chortled, "did." He put down the lighter.

Stretch looked down at his hand, where flakes of the white powder had settled on his fingers around the match. "It burns," he said.

"No," Praz said, "it out is."

"Not the match, my hand. That powder is burning my hand."

"Put match down," Praz said, "and hands wash. Powder soluable in water is."

Stretch dropped the match and, with his hands held before him like a surgeon's waiting for the rubber gloves, he fled into his private washroom in the rear of his office.

After a minute he emerged from the washroom rubbing a coating of burn ointment into his hands. "I don't know," he said, looking at Praz, "whether the twentieth century is ready for you yet."

Praz looked startled. "You pleased to joke are," he said.

"About what?"

"Century. Twenty-two is, yes? Not twenty?"

"Now, why would I joke about a thing like that? Everyone knows what year . . . oh." Keeping his newly greased hands well away from the red leather of the desk top, Stretch gingerly sat down. "You're serious."

"Serious am," confirmed Praz.

Stretch turned the desk calendar around to face Praz. "There," he said, "see for yourself. April fifteenth, 1965. That's A.D., of course."

Praz jumped up and hastily closed the attached-case. "Serious mistake been made has," he said. He shook the handle, and the case rose and disappeared into the black handgrip.

Stretch no longer doubted the authenticity of the gentleman standing before him. He rallied all of his powers of persuasion. "You mean the authorities don't

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permit you to sell in this . . . time?" he asked, ready to point out the mutual advantages of some sort of blackmarket activities.

"Not question of permitting is," Praz said. "Question of possibility is. Time travel like travel in car suspended between two mountains is. Both sending and receiving stations exist must before travel between them possible becomes."

"Oh," Stretch pondered over the answer. "So you can't travel back to any earlier than when the first machine was invented?"

"Right is. And first machine not invented until twenty-two in number of centuries was."

"But then, how did you . . . what are you doing here?"

"One explanation possible is," Praz said, pocketing the animal-cracker producer, "abortive experiment in mid twenty number century. Professor of name like Blatsky at Water Edge Institute father of time travel became unknowingly when he produce travel field for two hours. Building blown up when he attempt to turn off machine was. I inadvertently tuned to his projection became must have." Praz glanced at the fire extincter hugging the wall, decided against wasting the time necessary to retrieve it, and hurried from the office. Stretch ran after him.

"Look, why don't we . . ." he started.

"No time." Praz trotted across the room, and entered the broom closet, slamming the door behind him. Stretch ran to the broom closet and threw open the door. It was empty.

"Miss Appleton," Stretch yelled, turning around. Miss Appleton didn't answer. She was sitting at her desk in what appeared to be a hypnotic state, staring at a varicolored stream of water which jumped and danced across the top of a long, thin ivory box on top of her desk.

Stretch ran across the room to the table which held the phone book.

There was no Water Edge Institute listed. Something nudged at the corner of Stretch's memory. He checked. There was a Seaside Institute right outside of town. Stretch dialed their number.

"Seaside Institute, good afternoon."

"Good afternoon. Have you a Professor Blatsky at the Institute?"

"Professor Blatsky? He's in his laboratory at the moment. Would you like to be connected with him?"

"I would very much, thank you."

"One moment." There was a pause.

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"Hello?" The voice could hardly be heard over the background noise.

"Hello. Is this Professor Blatsky?"

"It is. Who is this?"

"My name is Stretch — George Stretch. Listen closely, I have something very important to tell you."

"Well," the voice at the other end sounded dubious, "if you say so. Wait a second, I'll turn off the apparatus — I can hardly hear you over the noise."

"*No*," Stretch shouted, as he heard the clunk of the earpiece being put down on the table. "*Blatsky, for Chrissake listen to me Don't . . .* " The phone went dead.

After a long moment, Stretch softly hung up the phone. He jammed a big cigar in one corner of his mouth, lit it, and stared savagely at the wall. Miss Appleton was still in her trance.

Stretch said a short expletive curse word experimentally. It sounded good. He repeated it, strode across the room and burst into his office.

A small, black object scurried across the office wall and spat accurately at his cigar tip. The cigar instantly went out.

Stretch was speechless.

— MICHAEL KURLAND

FORECAST

A decade and a half ago, just about exactly, a small group of science-fiction writers and others were busily putting the finishing touches on a proposed new science-fiction magazine. The man in charge of the operation was H. L. Gold; the magazine was *Galaxy*.

Well, time has passed. Due to reasons of personal health Horace Gold has had to curtail his activities, and one of the activities curtailed was editing *Galaxy;* but in the decade-plus during which he was at the helm he produced a magazine which almost literally turned the field upside down. He gave us Fritz Leiber's *The Big Time* and Isaac Asimov's *The Caves of Steel;* he published most of Robert Sheckley's earliest stories, and many of Clifford Simak's best ones. He spurred Cordwainer Smith and myself — that is, the fellow who is now running things, Frederik Pohl — into regular writing; and he retrieved writers like Ray Bradbury and discovered writers like Edgar Pangborn.

Next issue is *Galaxy's* fifteenth anniversary. We propose to celebrate it with a special issue. It will have stories by all the people we've mentioned — yes, Gold, Leiber, Asimov, Sheckley, Simak, Smith, Pohl, Bradbury and Pangborn, among others — and we think it will be a collector's item for a long time to come . . .

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THE SHIPWRECKED HOTEL

by
JAMES BLISH and NORMAN L. KNIGHT

Illustrated by MORROW

A hotel doesn't have to be on land. There's no reason one shouldn't float in the ocean. The trouble with this one was . . . it didn't!

The "optimum" and "maximum" densities of population that can be supported by a single planet without access to external resources have been the subjects of perennial speculation. Both terms are relative and their definitions have varied in time and space according to the conditions currently prevailing on a given world. If we accept the opinions of the inhabitants "optimum density" has been achieved and approximately maintained on sundry worlds at different times. The various estimates of "maximum density" never have been verified conclusively by actual experience but the history of our ancestral Terra during the late Twenties provides us with the closest known approach to an experimental determination.

At least one thinker of the ancient world believed that the maximum density is also the

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optimum. We refer to the social and economic analyst Henry George . . .

Rimstar: *Introduction to Galactic Archeology* (7007 E.C.)

That the earth could maintain a thousand billions as easily as a thousand millions is a necessary deduction from the manifest truths that, at least as far as our agency is concerned, matter is eternal and force must continue to act . . .

Henry George: *Progress and Poverty* (1879 etc. E.C.)

In the year 2794, the Earth maintained in comfort a population of a thousand billions — and they all lived happily ever after. But it wasn't easy . . .

I

In the spring of 2794, Jothen Kent, who was the senior water engineer of a standby Disaster City named Gitler, Mo., was still trying to persuade Kim Wernicke to marry him. It wasn't easy. In pursuit of this campaign, he had managed to wangle a joint vacation for the two of them from the Union of Occupied Classes. That hadn't been easy, either, but love occasionally laughs even at UNOC, which has to process — and mostly refuses — 1.6 billion vacation applications per month.

He picked her up at Starved Rock Biological Preserve, where she was an ecological surgeon. The Rock was a much coveted vacation resort in itself, for here one could see a sampling of some of the many thousands of animal and plant species which had once been allowed to run wild over the face of the Earth, all carefully housed in compartmented environments as much like the originals as human ingenuity could devise. For a population used to nothing but the megalithic cities, and the unending bamboos, giant sugarcane, hybride poplars and Monterrey pines which made up the World Forest, a place like the rock was a fairyland.

Jothen wasted no time gawping at it, however; for one thing, he had seen most of it before, and as an engineer his interest in wildlife was small at best. Instead, he pushed his way as rapidly as possible through the other visitors on the mobile sightseers' highway, cherishing his surprise.

Kim's sector was North American Temperate, the only remainder of that once vast, bluely sylvan, raptly still ecology anywhere on Earth; the last fragment of the realm of deer and bears and wolverines and wild tobacco and sugar maples and oaks, and quiet everywhere under smoky skies. Here, at least, it would never change, and for that reason Kim clung to it —

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not for the rainbow trout in the brooks, nor for the snow that fell every year, or the squirrels which sat in the crotches of unfamiliar trees chiselling away at black walnuts, but because this was all of it that there was or ever would be, and it was permanent and immune to man in its glittering silicoid womb.

Or so — cloudily, to be sure — Jothen saw it. He did not pretend to understand Kim well.

He stepped off the highway at the base of the sector HQ tower, and finally was allowed the use of an official elevator to the sector surgeon's office. Kim came forward at once, holding out her hands. She was a tall girl of the type that was once called Canadian blonde, with long black hair, blue-green eyes, and four-count-them-four dimples, and as usual she took his breath away.

"You're as prompt as ever," she said, smiling. "Nobody's prompt any more. But for once I'm almost ready."

"Good for you. We'll need to stay on schedule — I have rocket passes."

"I know, that's why I hurried. I'm all packed. But Jo, where are we going? Is it still a mystery?"

Jothen grinned. "No, not any more. We're going to Australia."

"Australia!" Kim clasped her hands together like a child. "Oh, Jothen! To the Barrier-hilthon?"

"No," Jothen said, drawing out his surprise to the last. "Nowhere so commonplace. Guess again."

"I can't. Tell me before I kick you."

"We're going to Triton Reef."

"Triton Reef! You mean — we're going to live *on* the Reef — with Tritons?"

"Don't look so distressed! The Tritons welcome Drylander visitors. They've got dry, comfortable guest quarters available, with all the modern amenities. You won't live twenty-four hours a day in a scuba rig or sleep in a tidal pool."

"Hmm," Kim said. "Somehow I've always thought of them as a cold and aloof sort of people — taciturn, except with their own kind."

"Nothing of the sort, I'm told. They're gay as dolphins. You'll meet dolphins, too. The Tritons will act as interpreters."

On Kim's desk, the telephone sounded three musical chimes, and she turned to it with an apologetic gesture. "Kim Wernicke here."

"This is the switchboard computer at the Barrier-hilthon. If you wish this conversation to be private please make the necessary preparations."

"It isn't necessary; proceed."

A click, a series of *pings*, and another voice: "This is the com-

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puter in charge of incoming mail. The parcel that you sent to Doctor Matouf arrived eight days ago. Doctor Matouf was absent then and has not yet returned. Shall I refer the material to Outgoing Mail to be forwarded to his Istanbul address?"

"Is someone caring for the specimens?" Kim said.

"Yes. We summoned an entomologist from Kookaburra Biological Preserve."

"Don't forward them then. Doctor Matouf was very specific that he wanted them held at the hotel until he returns from his current field trip. The Barrierhilthon is his present base of operations."

"As directed," the computer said. Came a silvery *ping*, then silence.

"You can see why the hotel was on my mind," Kim told Jothen.

"What was it all about?"

"This Turkish entomologist — Kemal Matouf, he's quite famous — is revamping the classification of the *Thysanura*. That's the group that used to be called silverfish. He maintains that the structure of their blood proteins reveals new facts about their evolutionary relationships. He's asking for specimens from everywhere."

"Sounds very exciting," Jothen said ironically.

II

The Great Barrier Reef is a vast platform of coral extending southward from the coast of New Guinea along the eastern shore of Australia for over one thousand miles. Parts of the platform are submerged under relatively shallow water; parts are awash at low tide; and parts rise above the high tide level as atolls and islets. The outer rampart of the Reef is a wall of coral as dense and hard as concrete, an impregnable breakwater against the battering waves of the Pacific.

Inlets along the barrier give access to the maze of channels, atolls, shoals, islets and sandbanks that lie behind it. This inner zone varies in width from twenty to one hundred and fifty miles.

Seaward from the outer rampart the water depth increases rapidly and finally plunges precipitously into the oceanic abysses.

The Reef is an intermediate realm; a bridge between the two dissimilar worlds of dry land and open sea; the natural symbol of the Tritons who colonized it. The Reef colony was the most popular Triton community in the world, surpassing even the West Indian settlement that extended from the Bahamas to the coast of

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South America. It was a community more dispersed, more self-sufficient, less mechanized and less regimented than the megalopoli of the Drylanders.

The Tritons were not, however, so self-sufficient as to be indifferent to the good opinion of the Drylanders, whose tectogenetic creation they were: a new human species, to exploit the sea — with their co-evals the dolphins — as the Drylanders never could hope to.

Triton Reef could not afford to ignore the Barrier-hilthon.

An observer on the outer escarpment of the Reef near the inlet known as the Lark Passage would have seen the upper portion of the Barrier-hilthon as a vari-colored dome riding on the sea about five miles offshore. Actually, the Barrier-hilthon was an artificial island with its base planted in the bottom ooze at three hundred fifteen fathoms. It was an enterprise of the Transportation Corporation that provided hotel accommodations for two million guests and a service staff of twenty thousand. Externally, its architecture was severely simple and compact — a steel globe thirty-five hundred feet in diameter. The portion above water showed itself as a dome thirteen hundred feet high with its surface divided into twelve segments of alternating colors — red, white, blue, white, red — that converged toward the yellow disk of the flyport at its summit. As seen from the air it irresistibly suggested but one metaphor — a gigantic beach ball afloat on the sea.

A projecting flange four hundred feet wide girdled the Barrier-hilthon at water level. The inner zone of this flange had been converted into a "beach" of white coral sand, complete with sea shells and picturesquely contorted fragments of weather-bleached driftwood. A sea-water swimming pool occupied the zone between the beach and the upcurved outer rim of the flange. This outer rim excluded surf, sharks, and barracudas, while its curvature and overhang discouraged venturesome swimmers who otherwise might have been tempted to climb over it. Direct contact with the open sea, of a sort, was provided by large stainless steel grilles set in embrasures spaced equidistantly along the curved sea wall. Rollers that dashed themselves against the grilles entered the pool as showers of spray and smooth surges of water.

Internally the Barrier-hilthon was an automated labyrinth of guest rooms, entertainment halls, service salons, escalators, moving floors, and elevators. Twenty

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levels each containing ten stories were reserved for these facilities; four more levels were for service installations. An indoor beach and pool encircled the hotel at the same level as the outdoor pool. Seen only by the service staff was another, hidden labyrinth between the walls and beneath the floors — a labyrinth of pipes, cables, wave-guides, and conveyor tubes radiating from the complex of service mechanisms and their controlling computers that were stacked in a cylindrical column along the vertical axis of the Barrier-hilthon. Except when medical or dental attention was necessary the guests very seldom saw members of the service staff other than the life guards and swimming instructors on the beaches. It never occurred to them that there was something slightly eerie in this state of affairs since they had been conditioned from childhood to daily services supplied by articulate computers and other electronic devices.

Situated on the second level beneath the flyport was the Master Computer that co-ordinated and supervised the subsidiary specialized computers which directed the automatic services of the Barrier-hilthon. But the Master Computer itself was supervised. In a circular control room at its core a twenty-five-man team of monitors kept constant vigil in four-hour shifts. They worked in a twilight obscurity lit only by the vidscreens and the winking luminous dots and squares on their consoles. Here the human mind impinged on electronic circuitry. Here the monitors received reports on matters specified by them. Here decisions were made and actions initiated in situations in which the Master Computer found itself incompetent to act without instructions.

The Master Computer spoke with a manifold voice. It carried on twenty-five different and simultaneous conversations with the monitors.

"The tropical storm over the Solomon Islands is increasing in intensity," announced the Master Computer to Monitor Nine, at the same time displaying a weather chart on the vidscreen. "It is centered over Bougainville, moving south-southwest at twenty miles per hour. Central wind velocity, fifty-five miles per hour. It may develop hurricane force. We are feeling peripheral wind and wave affects. Hurricane Advisory Alpha has been issued."

"Wait twenty-four hours before issuing any further Advisories," replied Monitor Nine. "By then we'll know more about the force of the storm and its path."

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To Monitor Fourteen the Master Computer said, "A report has been prepared on the alleged appearances of arthropods in guest rooms. Do you wish to receive it now?"

"Proceed."

"Two complaints have been received, claiming that arthropods were seen in guest rooms. The investigator interviewed the complainants and showed them life size 3-V movies of various arthropods with a portable viewer.

"Complaint Number One: Madame Renee Lamotte reported seeing a scorpion in her bath-spray compartment. Stated that she knew it was a scorpion because, quote, it had a sting on its tail, unquote. When shown the movie of a scorpion she denied that it resembled the creature that she saw. Her comment on the movie of an earwig was negative also. By this time she was in a highly agitated condition and refused to look at any more pictures. Her husband privately advised the investigator that Madame Lamotte has had an insect phobia since seeing a so-called historical 3-V drama of life during the Age of Waste, with emphasis on the prevalence of insect pests.

"Complaint Number Two was filed by Mulaka Ouagadu, who reported finding a centipede in a slipper. He failed to identify the pictures of a centipede with the creature that he claims to have seen. After viewing three other pictures he refused to go on because he found them emotionally disturbing. He does not know Madame Lamotte but had heard the rumor about the scorpion.

"Investigator's conclusions: Madame Lamotte is a neurotic woman who imagined that she saw an insect-like creature and called it a scorpion. Ouagadu heard the scorpion rumor, became alarmed, and also had arthropod delusions. It is the investigator's opinion that neither of the complainants, quote, are capable of distinguishing an ant from an angleworm, unquote.

"No other complaints in this category have been received. End of report."

"Make a general announcement to guests and service personnel," directed Monitor Fourteen, "that rumors of scorpions et cetera in the Barrier-hilthon have no foundation in fact."

The Master Computer said to Monitor Three, "The party of Tritons and dolphins is approaching Sector Twelve as scheduled. The necessary announcement is being made via the beach PA system."

The multitude on the beach halted their activites and listened to the resonant synthetic voice

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that rolled from the concealed speakers on the colorful dome that towered above them.

"This is the Voice of Barrierhilthon. We have made arrangements with the Tritons of Great Barrier Reef whereby you are about to receive visitors of a most unusual nature. In a few minutes some of the grilles in the sea wall of Sector Twelve will open and Tritons and dolphins will be admitted to the pool. No doubt each of you has heard many tales of various degrees of accuracy regarding Tritons and dolphins. Now you shall see them, talk to them, and obtain your information at first hand."

There was a general exodus from the pool and a babble of voices rose from the beach in agitated crescendo, subsided, and was followed by an expectant silence punctuated by the rhythmic swashing of water through the grilles as billows broke against the sea wall. Abandoned beach balls and plastifoam rafts bobbed about in the pool.

Three grilles slid aside with metallic clashes and disappeared into slots in the sides of their embrasures. Through these openings the spectators on the beach saw the glistening curved front of a massive turquoise-green billow unheave itself, fling itself toward them, and pour into the pool in three hissing cataracts. Three dolphins plunged through on the crests of the cataracts, their sleek arched bodies momentarily half out of the tumbling foam-flecked water. A bronze-skinned Triton child lay prone on the back of each dolphin between its head and dorsal fin, arms and legs clasping the dolphin's body. Dolphins and children vanished in a white smother of foam. Then, midway between beach and sea wall, the dolphins surfaced explosively in a tremendous power leap that carried them to ten feet into the air. At the apex of their parabolic flight the three Triton children slid sidewise from the dolphins' backs, and children and dolphins dived into the pool in unison. A burst of applause rose from the beach.

With the arrival of every billow more water gushed into the pool bringing more dolphins, more Tritons. Some of the Tritons had skins of a rich brown color, some were purplish-black, some were like brown-tinted ivory, others were dappled. The pool became alive with swimming Tritons and leaping dolphins.

The three grilles clashed back into position.

The dolphins were quick to perceive the possibilities of the floating beach balls and butted them into the air, aiming so that the balls fell into the throng on the

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beach. At first this created flurries of surprise, but the onlookers rose to the occasion and flung the balls back into the pool. A lively two-way beach ball bombardment began.

The crowd commenced to move back into the water. Soon everyone was in the water. Even the non-swimmers were in waist-deep. Several haphazard games of water polo got themselves organized. Triton children were instructing children from the hotel in the sport of dolphin riding. Tritons and guests raced each other to the sea wall and back — an unequal match, it should be recorded. There were experiments in conversing with dolphins. The air rang with shouts, laughter, and splashing.

A Triton girl hoisted herself from the water onto a plastifoam raft, stood erect, her black skin glistening like mobile obsidian, and emptied her gill-chambers by ejecting multiple jets of water from the slits in her sides. A ring of swimmers collected around the raft, clung to its edges, and plied her with a barrage of questions.

"Why did you squirt spray like that?"

"I can't breathe air unless I empty the water out of my gills."

"I don't see any gills."

"They're inside, where you have your lungs."

"How long can you stay out of water?"

"I have been out as long as twenty hours."

"What's your name?"

"Ruvani."

"Do you eat raw fish?"

"Raw fish! Ugh! No! Mostly we eat from an autoserver. Sometimes we catch fish, or crabs or lobsters, or dig clams, and cook them with a fire outdoors."

"A *fire! Nobody* is allowed to make a fire! You might set fire to The Forest!"

"There isn't any forest where we make our fires. We make them with driftwood on little islands behind the Barrier. Most of them are sandbars or bare rock. Some of them have a few wild trees. They're too small to bother planting a forest on them."

"What's that little rod fastened to your belt?"

"That's an electric shark prod. It pulls out into a long rod — like this. When a shark comes too close I touch him with the tip, give him a shock, and he goes away."

"It's such a thin little rod. Where's the battery?"

"There isn't a battery. The electricity comes out of me. Like an electric eel."

"Out of you! Oh, really —! I don't believe it. Prove it."

"All right. Put out your finger. Now I'll touch my finger to

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yours. I'll try to make the shock as light as I can. NOW!"

"Ouch!"

"Convinced?"

"Yes! My arm hurts clear up to my shoulder. Could you kill a person?"

"I don't think so. I've never tried. I *have* killed moray eels."

"Don't you feel the shock yourself?"

"Not the way you did. It feels — it's hard to say how it feels. It's a sort of thump between my shoulder blades, like being hit with a rubber hammer."

"Why do you use a rod? Why don't you just touch the shark with your hand?"

"Too risky. When a shark feels a shock he may lash around with his tail or bite blindly in all directions. Or he may take off like a rocket. One can't be sure of what he may do."

Ruvani's ordeal — though she bore it very well — might have gone on for an hour, as it had often before; but this time she was interrupted. A siren wail from the PA speakers rang over the pool.

"Your attention, please," a commanding voice boomed. "Your attention, please. A tropical storm is approaching from the northeast. Clear the beach and pool. Guests will please return to the hotel and remain indoors until further notice. The grilles will be opened and Tritons and dolphins will kindly return to their homes. That is all."

There was a general stir of movement on the beach, but it was not a scramble. There had been something vaguely reassuring in the tone in which the computer had said "That is all," as though tropical storms were no novelty to the Barrier-hilthon.

As indeed they were not; but the computer's "That is all" had not been quite candid. In fact, hazardous conditions on the beach due to the approaching storm were not likely to occur for another twenty-four hours. The object of the warning had been to move everyone to a safer location, without causing a panic, in order to avoid a danger of an entirely different nature.

Ten minutes ago, the Master Computer had stunned the monitors by announcing:

"THE BARRIER-HILTHON IS SINKING."

III

When Jothen Kent had been flying toward Starved Rock Biological Preserve some hours previously, his attention had been focussed on the Preserve itself, his thoughts wholly centered on Kim. But now Kim was with him, they were flying to make the rocket connection at Chicago, and

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the Preserve lay far behind on the southwestern horizon, gleaming under a late afternoon sun.

Now he was scrutinizing a puzzling phenomenon that had appeared on the skyline ahead. It resembled a low range of mountains, grayish mauve in the distance, that lay along the entire northeast quadrant. Mountains? In Illinois? As they drew nearer he could see the usual forested terraces, but the bluffs that separated the terraces were bands of pastel colors. He turned to Kim.

"I'm surprised to see mountains here. I thought that all of this region was as flat as a table top."

Kim laughed. "Jothen! That's Chicago! Or rather, it's one corner of it."

As the helicopter churned steadily across the sky, Jothen stared fascinated as the terraced ramparts seemed to rise higher and higher, and extend themselves endlessly on either hand. Even before the first architectural mountain range was overpassed, still other ridges, peaks, chasms and buttes rose beyond it. Soaring towers and masts, great glittering domes, and skeleton frameworks of new construction materialized in the blue distance. As they advanced farther, the monolothic city spread beneath them from horizon to horizon, a bewildering tracery of green terraces and tinted walls.

"I suppose I shouldn't be astonished," Jothen said, rousing himself from his hypnosis with considerable effort. "I've seen some of this in photobooks. But I never appreciated the real bigness of it. I've been holed up in a Disaster City for so long that I've forgotten how jammed the rest of the world is."

A great climactic pyramid reared itself before them, a Mount Everest towering above lesser peaks. The sun, low in the west, lighted its terraces and walls with a coppery glow. The forefront of a convoluted, lowering gray cloud-ceiling was gliding above it, carried toward them on the wind off Lake Michigan. As Jothen watched, a rippling misty curtain of rain descended from the cloud, blurred the outlines of the pyramid as with a veil of pearl-gray gauze, and bloomed magically with a giant rainbow ring. The circle of spectral colors formed a softly glowing frame around the pyramid.

"Now there's a perfect symbol of our endless argument," he said thoughtfully. "A circular rainbow—no end, no pot of gold."

"And no marriage," Kid said. "This is no world for children."

"Some people might think it beautiful. Look out there."

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"I'm looking. That overgrown pyramid underneath your symbolic rainbow is the Municipal Services Center. It serves this whole urban monstrosity—three billion people, plus a million or two by the latest count. You see only a fraction of the pyramid; most of it's out of sight, like an iceberg. It goes down to bedrock and deeper.

"Somewhere inside there is the headquarters of the Civic Medical Services. I was born there. Every day, about fifteen thousand babies are born there and at each of the nine outlying regional centers. Conveniently next door, there's a branch of the Municipal Crematorium. Their total daily output is about one hundred forty thousand cremations—a net daily population increase of ten thousand. And for what? So this frightful human termitary — vitrolith and glastic and metal, pipes and cables and computers, escalators and elevators and moving floors—can go on growing bigger and bigger, higher and higher, deeper and deeper, forever!"

"Take it easy," Jothen said. The helicopter flew into the curtain of rain and the rainbow circle vanished. Kim plowed on without noticing.

"Do you *have* any idea how big this town is? It runs northward to Sturgeon Bay and westward halfway across Wisconsin and Illinois. From some of the high points on the west wall you can see the Mississippi on a clear day. It spreads fifty or sixty miles southward into Illinois and Indiana, and then on up into southern Michigan. Recently it annexed Lansing. The east wall is only about fifteen miles from the west wall of Detroit. It's an ugly tumor on the face of the Earth—and we're the viruses that created it. I don't fancy the idea of increasing the virus population. There are too damn many now."

The helicopter veered around the pyramid. Only the higher pinnacles of Chicago's jagged roofscape still smoldered in the orange-red light of the fading sunset. The rain had ceased. Venus shone like a pale emerald in the blue-green ribbon of unclouded sky in the west. Along the eastward rim of the world constellations of colored lights flashed into being—some shining steadily, others blinking a coded rhythm. They marked the far-flung flyports along the lake front, one of which sheltered their rocket shuttle.

"People aren't viruses," Jothen said. "People have hearts and minds. All right, Chicago has a three - billion - plus population. That's another way of saying that it possesses more than three billion minds."

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"Only a small percentage of which are being used for anything," Kim said. "The rest are just contented-animal minds, dreaming on warm cushions. Cozy, but—"

"But that's not the whole story. There are degrees of creativity. Most people are creative in some degree. Their abilities may range from a simple knack of making up stories and jingles for their children, or for decorating an apartment, up to the genius level. If there's one genius for every hundred thousand people in Chicago, that's—mm—three hundred thousand. On the basis of the world population, that's one hundred million high-level productive minds.

"Of course only a relative handful is keeping us fed, housed, healthy, literate. But why stop there? There are millions doing imaginative, creative work—some of it revolutionary, some of it trivial—on their own initiative simply because they can't endure idleness. There are amateur mathematicians, astronomers, potters, botanists, historians. There's a group in Paris that has revived the art of printing on silicose; I've seen some of their books, and they're stunning. There's Doctor Matouf and his silverfish. Never underestimate the Doctor Matoufs. Who knows what could come of all this activity—this spare-time, just-for-fun activity?"

Kim looked at him speculatively for what seemed quite a long time. At last she said: "Jo, what led you into all this?"

"My work only occupies part of my time. Mostly it's a matter of routine inspection and reports. If a leaky valve needs replacing, it's an event. The rest of the time, I read—just-for-fun. And it seems to me that the city isn't just a malignant growth running wild. It's like the rest of the world—a hive of creative brains. Does anyone have the right to refuse to marry and beget minds? The world needs all it can get, even if ninety-nine percent do little more than vegetate."

"For your information, Jothen," Kim said deliberately, "you have a one-track mind."

"If that's your argument-in-rebuttal, I can't give it a very high rating," Jothen said. "The only trouble is, any kind of No is still a No. Well, I'll stop spoiling your vacation for a while at least. We're touching down; next stop, Cedros Island—and then the Reef."

IV

From the moment of the Master Computer's stunning announcement, the monitors were

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ed up in emergency actions and trying to locate the malfunction in the Computer that had nerated the announcement. It id to be a malfunction. But it as a first-magnitude malfunction, and the monitors were taking no chances.

The check-out of guests was oceeding as usual. Guests en ute to the Barrier-hilthon had en halted in transit. The watertight doors of all entrances had en closed and secured. Only the eck-out exits remained open. ransportation Corporation had en informed that evacuation of e hotel might be necessary.

The reports relayed by the aster Computer indicated an creasing loss of co-ordination its subsidiaries. The Barrierlthon was sinking . . . The Barer-hilthon was not sinking; it as still securely embedded in e bottom ooze . . . The aquaione switchboard had ceased to nction, thereby blocking underater communication with subersible ferries and shore installations . . . Computer 5B (in iarge of Ballast) had activated l pumps at full capacity and as emptying the ballast tanks . Communications were broken etween the Master Computer id Computer 5B . . .

All off-duty shifts of the mainnance staff had been recalled id the combined force was searching for the malfunction. One task force had been ordered to stop the pumps manually. The series of doors leading to the Manual Pump Control Center had been closed by Computer 5B and had to be manually opened—only to be closed again by Computer 5B, doggedly following the electronic command, "Activate all pumps and keep them going until ordered to stop."

As the technicians checked and counter-checked the multi-million components of the Barrier-hilthon it became evident that there was not one malfunction but several. The hotel was afflicted by the computorial equivalent of schizophrenia.

The monitors by-passed the Master Computer and issued a direct-line order to Maintenance Supervision: "Kill Computer 5B and stop the pumps."

Killing the computer was a simple matter of shutting off its power supply. Stopping the pumps was a more complex operation. There were two thousand pumps and they could be shut off only in sector units. To maintain the Barrier-hilthon's axis in a precisely vertical position it was necessary that they be stopped in a definite sequence. It was an operation that never before had been manually performed. When the newly built Barrier-hilthon had been lowered

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into its present position the ballast tanks had been filled under the control of the computers. Since that day only slight automatic adjustments in buoyancy were necessary to compensate for the daily tidal cycle. The possibility that the Barrier-hilthon might spontaneously attempt to become free-floating had not been anticipated; the designers had envisioned nothing more than local flooding due to structural failure. Now, during the first stages of the manual shut-down of the entire ballast-pump installation, great volumes of water continued to be discharged and the Barrier-hilthon's buoyancy increased.

The guests of the hotel, still happily unaware of the disaster that was taking shape, paid little heed to the transient shudders that quivered through the steel fabric of their automated microcosm. The few who noted them ascribed them to the impact of breakers on the windward sea wall. But the monitors knew otherwise. The steel globe had detached itself from the adhesive bottom ooze and was just barely afloat in its bowl-shaped emplacement.

The technicians manning the pump controls lacked the smooth co-ordination of Computer 5B. Their eyes were fixed on the tilt gauges, watching the axis of the Barrier-hilthon for slight departures from the vertical. Repeated minute tiltings and hasty compensations created an atmosphere of growing urgency tinged with panic. The result was a jittery, exaggerated caution and increasing slowness in their operations.

Meanwhile the Barrier-hilthon floated higher and higher. The jutting flange that supported the beach and swimming pool was more than one hundred feet above water level, exposing its underside and a zone of the spherical hull encrusted with sea growths. The water from the pool poured through the grilles in noisy cascades. The docks for hydrofoil and submersible ferries, that transported guests to and from the mainland, were likewise above water level. Hotel guests were ordered to retire to their rooms, to remain there until called, and to prepare for departure.

During these events a high-speed colloquy was taking place between the Barrier-hilthon's Master Computer and the Master Computer at the Triton-operated base known as the Lizard Island Complex, inside of the Reef.

"Barrier-hilthon to Lizard Island. Emergency. We are about to become free-floating due to computer malfunctions. Ferry

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docks are above water level. Evacuation is proceeding via flyport only, imposing ten times normal load. Need all available helicopters and hovercraft."

The same appeal was transmitted to Transcorp by way of Prime Center.

But the Lizard Island Tritons had further plans for speeding the evacuation.

"Lizard Island to Cairns' Reef. Emergency. Relay to satellite reefs. Barrier-hilthon will soon be adrift and is being evacuated. Send all submersible ferries to cooperate with aircraft. Sea is too rough for hydrofoils. Evacuees will be transferred from flyport to submersibles via rescue slings."

"Lizard Island to Snake Reef. Emergency. Relay . . ."

"Lizard Island to Osprey Reef. Emergency . . ."

The first flights of aircraft from Lizard Island and Snake Reef arrived at the flyport an hour ahead of the flight dispatched by Transcorp from the mainland. At the same time the Barrier-hilthon swam clear of her emplacement crater. Under the mounting force of the southwesterly wind her enormous mass yielded sluggishly and began a creeping, reluctant drift toward the northeast and deeper water. All of her more massive installation — power plant, sea water distillery, fresh water storage, sewage processing —were in her lower levels. Her center of gravity was still below the water line. She moved with the ponderous steadiness of an iceberg, ignoring the increasing roughness of the sea.

Maintenance Supervision reported to the monitors that one malfunctioning module had been located and replaced, and that automatic pump control was restored. The pumps were stopped and the hotel continued her drift with the elevation of the outdoor beach and pool—now completely drained—at slightly more than three hundred feet above their normal level.

Lizard Island received another distress call from the hotel's Master Computer.

"Barrier-hilthon to Lizard Island. We have been hit by a fifty-mile gust. Aerodynamic force on outdoor swimming pool flange tilted vertical axis two tenths of one degree, causing oscillation of water in indoor swimming pool, which overflowed into adjacent halls. We are draining indoor pool. Increasing wind may cause dangerous rolling. We must resubmerge partly or completely to normal level. Take a fix on our position and give us probability of sunken crags or reefs in our extrapolated course."

The reply came after a momentary pause while the Lizard Is-

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land computer consulted its electronic memory and triangulated the Barrier-hilthon's position with radio direction finders.

"Lizard Island to Barrier-hilthon. Existing depth charts for your location are obsolete. Recent collapse of submarine cliff and extensive mud slides have drastically altered bottom contours. Resurvey incomplete. There was a submerged granite peak very close to your extrapolated course. If its position and depth are the same as before you may collide with it whether you submerge or not."

The removal of evacuees by aircraft and rescue sling was proceeding from the outdoor beach as well as from the flyport. The operation was hampered by the roughness of the sea and rising wind. The transfer from swaying rescue slings to rolling and pitching submersibles had to be made in the water by swimming Tritons, who removed the occupants of the slings in a welter of waves and foam and swam with them to the submersibles where Triton hands hauled them aboard. The rate of transfer was frighteningly slow. In four hours approximately five thousand had been evacuated, and darkness had fallen. The tossing navigation lights of submersibles clustered around the Barrier-hilthon like a swarm of red and green fireflies. The beams of their searchlights played over her striped dome, probed the air above for descending aircraft, swept to and fro over the tumbling waves.

Since she had not been designed as a navigable sea-going vessel the Barrier-hilthon possessed no motive power, no rudder, and no sounding devices, obstacle detectors, or other navigation aids. The monitors were kept informed by the Lizard Island computer of their position and course with reference to the last charted position of the sunken crag. All occupants of the hotel had been advised of the probable collision and were in their rooms with the water-tight doors closed and secured. Everyone was waiting, listening for the first premonitory shock or sound. The steel globe had become, in effect, one vast, blind, intently listening entity.

The granite crag, studded with uneven rocky fangs, was the visible portion of a larger mass that lay buried in mud and coral sand—one corner of a great block that had been detached and upended by some ancient earthquake. Its total bulk, had it been visible, would have dwarfed the Barrier-hilthon. And it had changed in neither depth nor position.

The Barrier-hilthon bore down

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upon the sunken menace with deliberate inexorable slowness. Her rounded side grazed its spiked and saw-edged summit. The granite plowed with grinding and crunching din through her outer and inner skins, inflicting a monstrous diagonal wound eleven hundred feet long. The rending metal emitted a jagged, rasping scream like the cry of some great beast in agony, then trailed off into a quavering squeal. Rumbling torrents of bubbles erupted from the gash and raced upward. The Barrier-hilthon reeled, and the people in her rooms were thrown upon the sloping floors.

At the first impact the hotel computers reacted with lightning swiftness. Each sector of every level was sealed off from the others. The axial service stack was sealed off from the rest of the structure. The doors to the beach and the flyport were closed. Sectors of the eighth, ninth and tenth levels were flooded; the unbalanced globe changed its direction of tilt.

The hotel went under swiftly. The sea poured over the sea wall and flooded the beach. The picturesque driftwood fragments floated away. A narrowing ring of foam climbed the red, white, and blue dome until the summit of the radio and video aerial atop the flyport control tower disappeared in an eddy of foam and driftwood. The pumps shifted ballast at top speed; the hotel gradually righted herself and came to rest on the oozy bottom with the top of her control tower one hundred and fifty feet below the surface.

Those who had been waiting on the windswept airfield of the flyport and on the outdoor beach had been washed away and left floundering in the stormy nocturnal sea. Each felt that his last moment of life had come. But the sleek flanks of dolphins rose on either side, pressed against him, and bore him up. The hands of Tritons reached up from below, supported him, and towed him toward the wave-tossed submersibles.

A preliminary report on the number of known casualties, the extent of the damage to the Barrier-hilthon, and the state of its automatic services had been delivered to the monitors by the Master Computer. The flood of telephone calls from terrified guests was being handled by computers in the lower echelons of the electronic hierarchy. A moment of silence prevailed in the control room. The submergence of the flyport aerial had closed that avenue of communication with the outside world. The thoughts of all twenty-five monitors were essentially, "What now? What do we do next?"

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The Master Computer spoke to Monitor One.

"You have a call from the flyport control tower. Do you wish to receive it?"

"The control tower! But there's no one there! We ordered everyone out before we went under."

"There is someone there now. Will you take the call?"

"By all means. Put them on."

The face of a blonde young woman appeared on the vidscreen in front of Monitor One. A lightweight scuba mask with minuscule oxygen tanks on either side was pushed back on her forehead.

"Hello, Control Room!" she called. "What has happened down there? Is it very bad?"

"Bad enough, but better than we expected. But who are you and how did you get into the control tower?"

"Perhaps you don't know me. I'm Dorthy Summer, head of Submarine Products Corporation. I came in a UWS—an underwater speedboat—with a Triton rescue team. They're going to inspect the damage to your hull and take measurements so we can put a patch on it. As to how we got in, there's a hatch in the roof of the control tower. We came in through that."

"That's the access hatch to the aerial. How did you open it without flooding the place?"

"We put a scapelock over the hatch and came in."

"A scapelock?"

"A prefab escape airlock. Do you mind if we come down? We're practically dry by now. We won't leave a wet trail. We'd like to take a quick look around and talk to whomever is available."

"I'll talk to you. We're just about to change shifts. My name's Defabio. I'll be in the Monitors' Lounge. All our transport systems are operating—except in the flooded sectors. Watch the location maps along the way. If you get lost use the nearest house phone and ask for Guide Service. The Level Computer will give you all the information you may need."

When Defabio greeted Dorthy in the Monitors' Lounge she was accompanied by a Triton whom she introduced as Tioru. Dorthy was sheathed in an insulated heat-retaining all-over suit of fluorescent orange-yellow plastic with webbing between the fingers. Tioru, like his fellow Tritons, was not chilled by prolonged exposure to water temperatures down to fifteen degrees Centigrade and was clad only in a yellow cincture. A green fiberglass cylinder with closed ends was suspended from a nylon cord around his neck.

"What's in the case?" asked Defabio.

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THE SHIPWRECKED HOTEL

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"Video tape," replied Dorthy. "I suggest that it be shown on your intercom system to everyone in the hotel. Then they'll know what we propose to do. It should raise their morale, and I suspect that it needs raising."

"And what do you propose to do?" Defabio inquired.

"Since this will be a project conceived and executed by Tritons I feel that Tioru should tell you."

"Thank you," said Tioru, bowing slightly to Dorthy, then to Defabio. "There are two things that we can begin to do at once. First, to get all of your people out of the Barrier-hilthon. Second, to repair the damage to your hull. You have something more than two million people aboard and the only way out, at present, is through the scapelock. We won't consider trying to get everyone out through that. It would be like draining a thousand-gallon tank through a pinhole. You'll need more scapelocks."

Defabio interrupted, "That scapelock on the control tower—how did you attach it without letting in water?"

"A scapelock is an eight-foot dome with an airlock on top. We cemented the dome to the roof with a metal-to-metal adhesive that hardens rapidly even under water. You couldn't pull it loose now without taking part of the roof with it. A built-in pump empties the water out of the dome and the airlock. We went through the airlock and opened the hatch. No problem.

"We estimate that we can install five hundred scapelocks on your flyport landing field without crowding."

"Five hundred! Where can you get five hundred scapelocks on such short notice?"

"We have a plant on Lizard Island that makes them, and a number of other things. We have a stock of about one hundred there and have begun making more around the clock. There are fifty more stored at Cairns' Reef. We have ordered others to be brought in by unmanned rockets from Fiji and the Andaman Islands. Still others are available in the Bahamas. Perhaps we won't need five hundred. We won't know until we have clocked the operation. We'll have to cut a hole through your airfield under each scapelock. We've requested permission from Transcorp to do this. It came through half an hour ago. I have a transcript for your files."

"Hold on!" protested Defabio. "The top of the control tower is one hundred and fifty feet down; the airfield, about four hundred. You can't shove people out through your scapelocks at that

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depth. The water's cold, and the pressure is around twelve atmospheres. They'd drown before they reach the surface. If they didn't die of fright first. This is the first time in their lives that most of them have been outside their native cities. Many of them have never been more than a few miles from their apartment until now. And about ninety percent of them can't swim."

At this point Dorthy broke in.

"The video tape will prepare everyone for the escape routine. And we'll put miniscubas on them. Like I'm wearing now. The little cylinders hold twenty minutes oxygen supply. They were made for Drylanders' use during brief underwater activity—when transferring from one sub to another while both are submerged, for example."

Tioru continued, "Each person will receive a five minute air-pressure buildup in the scapelock. Outside there'll be a Triton or a dolphin waiting. When he emerges he'll be hauled up to a sub and through its airlock before he can count ten. He won't be exposed to the cold and pressure for long, and he won't have to go all the way to the surface. The subs will be only forty or fifty feet above your airfield. It's fortunate that you're down as deep as you are. It's blowing fifty miles an hour up above.

"As soon as one sub has a capacity load it will move out and another one will move in. There'll be a traffic control system for subs set up in your control tower. We'll bring our own aquaphone T and R equipment. And we're setting up receiving centers on the mainland for your people.

"Now—casualties. How many casualties do you have?"

"The casualty check is still going on," replied Defabio gloomily. "We have twenty-three deaths that we know of. And a list of fractures and dislocations a yard long. Over two hundred when I came off duty. We can't get to the ones in the flooded sectors. The rooms are tight but the halls are full of water under about twenty-eight-hundred-foot depth pressure. We can feed them via the autoservers as usual, and send in first aid materials through the parcel conveyor tubes. We can give them first aid instructions by vidphone, provide music and 3-V movies, and that's all."

"We'll take out the accessible casualties first," Tioru said. "The inaccessible ones will have to remain inaccessible for a while. We can't open the rooms in the flooded sectors until we can pump the water out of the halls, and we can't pump the water out of the halls until we've repaired the hull."

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"There's another thing," Defabio added. "Small children and babies. We have forty-seven newborns in our maternity ward—which is in an upper level, happily, so it's not flooded—and swarms of older kids."

"We've thought of them. We have something special. You'll see. Don't worry."

"Don't worry!" Defabio said with a wry gesture; but of course he had to trust Dorthy, if not the Triton. He stood up. "This will take a full-scale meeting of the monitors to make it official, but I'll take it upon myself to approve the whole project. No one in his right mind could object. We too would like to get out of here alive. I'll put your video tape on our intra-mural network at once. You notify your Triton HQ to get the rescue operation rolling."

Then he paused, looking momentarily non-plussed. He said: "How does one say 'Thank you' on behalf of two-million-plus people?"

Tioru said gently: "To begin with, you wait until there's something to thank us for."

V

The rocket carrying Jothen and Kim had traversed five time zones and was entering the sixth. During the first half of the flight they had seen little other than the immense expanse of open sea—a world of blue water and armadas of clouds that, seen from an altitude of three hundred miles, were shreds of white fluff that seemed to rest on the blue.

In the latter half of the flight they viewed, from an apparent altitude of five hundred feet, mile after mile of ocean that was churned into transient rosettes of foam by leaping fish—a minute fraction of the incalculable horde beneath the surface. The sea twinkled with the flashing myriads of silver-scaled bodies. A floating fish-processing plant cruised slowly through the agitated waters, reaping a living harvest. Once they sighted a herd of whales, fringed by dolphins—a curiously pastoral sight.

Now the Zoomvision viewers showed irregular green shapes embossed upon the blue field, each bordered by a white line of beach and surf. Scattered among the lush islands were the white rings and crescents and filagree patterns of reefs and atolls.

"If we're on schedule we should be near the Solomon Islands," Jothen said. "I think I can see a few of them strung out along the horizon. And there's something a bit more spectacular. Take a look, Kim."

"I see some elongated islands," Kim said, "and a whirlpool of

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clouds coming up over the rim of the Earth. It's like a scale model of a spiral galaxy."

"It's the topside of a typhoon. This one must have built up so fast that it got out of hand before the Weatherwatch boys could spike it. I hope Osprey Reef is well out of it."

"Is that where the Triton family's to meet us? What do you know about them?"

"Very little. There are three of them. The father's name is Storm, which I hope isn't prophetic. He's an assistant to Dorthy Summer, the head of Submarine Products. Their home is on a coral islet they call Seahorse Reef. It's part of the outer Barrier. I . . . I'm afraid I told Storm we might be on our honeymoon."

"You," Kim said, "are absolutely incorrigible."

"I've been practicing," Jothen admitted. But he was given no chance to pursue the subject further.

"My viewer's gone dark," Kim announced plaintively.

"So has mine. We must be starting re-entry."

"I'm sorry to have to tell you this," Storm said, "but something has happened that alters all of our plans. We are not going to be very good hosts, I'm afraid, and your vacation may not be very restful."

Jothen found it difficult not to stare at Storm's rhythmically falling tears—all the Tritons wept mechanically when out of water, a transitional defect breeding had yet to remedy—and his fleshy, plume-shaped auditory antennae, constantly aquiver. He did not seem to disturb Kim, but then she was used to biological oddity.

"Nothing personal, I hope?" she said.

"No. A disaster at the Barrier-hilthon. Let's board the sub and then I'll tell you the whole story."

Storm's *Sea Dart* was a slender five-man craft propelled by centrifugally driven water jets. He took her down to five fathoms and left the rocket port's harbor by an underwater exit. Here the conning tower's vidscreen showed only a dusky green obscurity.

"You'll find this hard to believe, and I'll not blame you," the Triton said. "But briefly, the storm you saw, plus a computer malfunction, floated the hotel out of its moorings and drove it into a submerged cliff. It went down like a stone—about a mile down, which isn't too bad considering that the hotel itself's thirty-five hundred feet in diameter, but bad enough. There were two million people aboard at the time—the worst marine disaster in history, unless we can get them out."

"Get them out!" Jothen said.

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"But the hull—the depth pressure—"

"The hull can take it," Storm said. "The hotel was built with a safety factor of five; it's mostly monocrystal iron fifty-six. The main problem is that the rescue area's at sixty fathoms. Needless to say we're working around the clock. And it occurred to me, Mr. Kent, that since disasters are in a sense your profession, you might like a look at what's going on."

"I would indeed. Kim?"

"Of course." She looked out at the murky water. "But will we be able to see anything?"

"Oh, the flyport—that's the work area—is illuminated. I can't take you down to see the repair crew at work on the damaged hull, though. That's beyond the safe limits for this boat."

The *Sea Dart* dived on a long slant, and the vidscreen darkened to a deep-violet-blue. A nebulous, ghostly area of greenish luminescence appeared on the screen.

"There it is," Storm said. "We have lights moored all around the flyport."

"Those poor people," Kim said. "It gives me claustrophobia just to think of being in that thing."

"Me too," Jothen said. "Especially when I remember that you wanted to go there."

"But not on a honeymoon," she said, startling from Storm a brief glance of pure bafflement.

The luminous area slowly expanded as the *Sea Dart* approached. It emerged from the aqueous haze and became the circular yellow expanse of the flyport, brightly lighted by a ring of buoyant shining globes, each reinforced with a cage-like gridwork of curved ribs. The globes were anchored around the rim of the airfield by mooring cables which were delineated by the red dots of marker lights. The field had been divided by lines of phosphorescent violet paint into a huge checkerboard whose squares were identified by shining violet numerals. Many of the squares were occupied by a scapelock—a squat dome surmounted by a chimney-like airlock.

Two of the nearer airlocks were connected to what appeared to be either thick cables or flexible pipelines that rose at a steep angle into the deep blue darkness. They undulated lazily and were studded with equidistant round red marker lights. In reply to Jothen's inquiry, Storm explained.

"You might call them a pair of supersnorkel tubes. When the hull was ripped open the Barrier-hilthon lost a great volume

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of air. Every time we open a scapelock it loses some air. The people in the hotel consume oxygen. There is a reserve of compressed oxygen in the hotel but we want to conserve it. So air is pumped into the hotel's ventilating system through one pipeline and out of it through the other. The pipes are metal but long enough to have some flexibility. The pumps are mounted on motorized barges at the surface; they can maintain themselves in nearly constant positions against the wind and current."

The dark masses of five submersible ferries hovered at a low altitude above the flyport like giant sharks—sharks with red and green navigation lights instead of eyes. Scores of Tritons and dolphins were swimming in the space between scapelocks and ferries. With a start of surprise Jothen realized the true magnitude of the scene by observing the apparently diminutive size of the swimming shapes.

Periodically a scapelock opened and disgorged a flurry of bubbles in a glow of light, to be followed by an awkwardly swimming human figure wearing a miniscuba mask. Immediately a Triton seized the swimmer and drew him rapidly upward toward a submersible. The lighted orifice of an airlock opened on the underside of the vessel's hull, the Triton thrust his protege into the opening, waited until the airlock closed, and then swam down to his assigned scapelock.

A submersible freighter floated down from the upper darkness and came to rest at a level above the ferries. An oversize circular port gaped open in its belly, emitting a bluish light, and from it a scrapelock descended at the end of a cable. A squad of Tritons converged on the scapelock, accompanied it during its descent to the airfield, and guided it to the center of a numbered square.

"We have been installing scapelocks since twenty-one hours last night," remarked Storm. "There are fifty scapelocks in this load. We can install a scapelock and have it operating in twenty minutes and hope to cut it to fifteen. We have slightly less than one hundred operating but the evacuation is still too slow. According to the latest report fifteen thousand two hundred people have been taken out."

Jothen did some rapid mental arithmetic. "At that rate it will take over one hundred days to evacuate everyone."

"True," replied Storm. "But the rate will increase as more scapelocks go into operation and as the teamwork improves. But

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we don't plan to rely on scapelocks alone. We are rushing construction of a larger model that a freighter can lock onto with its cargo airlock. Then we can deliver provisions directly into the Barrier-hilthon on a conveyor and take on a steady flow of passengers at the same time, through the same airlock, with a mobile escalator."

"Provisions. That would be a problem," reflected Jothen. "How much does the hotel have?"

"Not enough. Routinely they carry a two days' supply. They're rationing what they have."

"I take it that the bulk food containers are too big to go through a scapelock?"

"Correct."

"Why not put the Barrier-hilthon on a ninety percent liquid diet? Pump it in. Through a pipeline. Soups. Purees. Low viscosity pastes. It will be faster than unloading package goods. Then the other provisions will stretch further."

Storm smacked his right fist into the palm of his left hand.

"Of course!" he exclaimed. "We can code it Project Quickflow. We have all the heavy duty plastic pipe that we need, at Lizard Island. We were laying an underwater pipeline when the Barrier-hilthon sank."

"An underwater pipeline? For what?" asked Kim.

"It's a Deep Water Safari project. Its object is to pump oxygenated water to a pilot-scale slime culture at the five hundred fathom level. We transferred the Safari people down here as soon as we heard that the Barrier-hilthon had gone under."

After explaining the Deep Water Safari and the slime culture project to Kim and Jothen, Storm called Lizard Island and gave orders which inaugurated Project Quickflow.

"We must move along," Storm said. "I have some inspections to make and you have seen everything here that — No! You haven't! One more thing. See that flashing light?"

A blue-green light was blinking rapidly at the summit of one of the scapelocks.

"What does that mean?" inquired Kim.

"It means that whatever comes out is to be given special care and attention," replied Storm. "We'll cruise along until we are closer to it."

The scapelock was near the edge of the airfield. Storm halted the *Sea Dart* so that they were within fifty or sixty feet of the winking light. Three dolphins and a Triton were circling around it.

The hatch of the airlock swung open, releasing the usual cloud of bubbles. A transparent sphere, ribbed with a grid of reinforcing

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rods, began to float out of the airlock. A miniature blinking glow panel illuminated the interior of the sphere.

"It looks like one of the airfield light globes," remarked Kim.

"It is one of the same type but with most of the glow lining removed, and a heater and other modifications added," Storm said.

The sphere was enclosed in a net bag with a line attached. A dophin darted in, seized the line in its mouth, and soared toward the nearest submersible, the sphere floating above it like a balloon.

Inside the sphere, stirring restlessly in a nest of white silicose, was a small, red, wrinkled baby.

"Well —!" ejaculated Kim. "How did that happen to be in the Barrier-hilthon? It looks as if it were born yesterday."

"It may have been," agreed Storm. "Or an hour or two ago. I understand that the maternity ward had over fifty of them when the hotel sank."

"What were the parents thinking of?" marveled Kim. "They must have known . . . Why didn't they stay at home?"

"When one makes a reservation at the Barrier-hilthon three or four years in advance one doesn't stay at home," replied Storm. "One goes ahead with one's vacation and has the baby at the Barrier-hilthon. It gives the parents something to boast about. The child also, when it's older. Now, who wants to go where? I'm about to make an inspection tour of the operation inside the Barrier-hilthon. Would either or both of you care to accompany me?"

Jothen spoke quickly. "I would."

Kim shuddered. "Not I. I've seen enough of this gloomy underwater world. I'd rather go to Seahorse Reef and watch the surf."

A call via aquaphone to the Barrier-hilthon enabled Storm to locate another Triton who agreed to convey Kim to the Reef in the *Sea Dart*. Jothen felt powerfully that he ought to go with her, after all; but thus far he had no reason to suppose sticking by her would advance his cause any further than parting from her for a while — and the opportunity before him now was one that would never be repeated.

Jothen experienced his first miniscuba transfer when he accompanied Storm into the Barrier-hilthon by way of the scapelock on the roof of the flyport control tower. Two recorded messages were awaiting Storm at his temporary office in the hotel. One was from Maintenance Su-

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pervision with the information that repairs to the hull had reached a stage that permitted the opening of one of the flooded sectors, Number Seven in Level Ten. The other message, from the Council of Monitors, stated:

"All computer malfunctions have been traced. Total number, seven; four of them in the Master Computer. Examination of the affected modules show that the cause was the same in every case — a short circuit caused by a small insect lying across two or more segments of the printed circuits. All were either dead or moribund when found. A specimen is being forwarded to your message receiving station. Still others have been found in the ventilation ducts. Presumably they were distributed through the hotel by this means. Their source is unknown."

The specimen was embedded in a square of clear plastic. It was a small, bristly, silvery-white creature less than half an inch long.

VI

"Could things like *this* sink the Barrier-hilthon?" demanded Jothen incredulously.

"It would seem that they did," Storm replied. "Another question: How did they come here? I wonder if the Barrier-hilthon has an entomologist among its guests?"

The word "entomologist" rang a bell of memory in Jothen's mind. He said, "There might be one by the name of Doctor Kemal Matouf. Ask the Guest Register Computer if he's still here."

Storm was informed by the computer that Doctor Matouf had been assigned to Room Ninety-Seven, Block Six, Zone Eight, Floor Five, Sector Seven, Level Ten; that this section of the hotel contained rooms provided with basic laboratory facilities for the convenience of guests on scientific missions; and that after the sinking of the hotel Doctor Matouf had ceased to answer his vidphone.

"Sector Seven, Level Ten," repeated Storm. "That's the one that has been reopened. I'll make a survey of the situation there and we can look in on Doctor Matouf at the same time. Let's hope that he's alive."

Jothen followed Storm through a maze of halls and chambers directly beneath the airfield. Here a team of Tritons was preparing a throng of hotel guests for their transit through the scapelocks. The air rang with the clamor of many voices. The Tritons were adjusting miniscubas, repeating last-minute instructions, allaying the fears of the timid. From this focus of activity an

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automatic elevator took Jothen and Storm to Level Ten — a two thousand foot plunge.

The halls in Sector Seven were wet and permeated by a dank fishy odor. Clean-up crews were clearing the halls of assorted fish, crabs, streamers of seaweed, jellyfish blobs, sand, and other marine miscellany. Many rooms were untenanted, with doors ajar; their occupants had been moved to vacated rooms on higher levels.

Jothen stepped warily around a small octopus that lay upon the floor, squirming feebly, just as Storm halted before a closed door bearing the number 10-7-5-8-6-97.

"Here we are," said Storm. "This is the doctor's room." He pulled on the door handle but the door was immovable. "I'll have to violate his privacy by unlocking his door and walking in. It's possible he may not be alive to resent it. An imperfect weld, a ruptured service conduit, and the sea would have flooded his room in an instant."

Storm unlocked the watertight door and pulled it open, revealing a brightly lit and incredibly cluttered room. A swarthy, heavy-set man looked up from the trace on the ribbon of paper issuing from the infra-red spectrophotometer clamped to a built-in work table beside him. His face expressed anger.

"Is it your customary behavior to burst into the rooms of others, uninvited?" he demanded.

"By no means," replied Storm. "Are you Doctor Matouf?"

"Of course I'm Doctor Matouf! Who are you?"

"My name is Storm. I'm supervising the Barrier-hilthon rescue operation under Doctor Summer of Submarine Products. It has been impossible to get a response from you for many hours although repeated calls were made by phone. It was suspected that you might be dead."

"You received no response because I disconnected the phone. Some prankster annoyed me with incessant calls about the hotel sinking. Obviously it can't sink when it's already on the bottom."

"It floated free and then sank. It rolled badly a few times. Didn't you notice that?"

"There was an earthquake. I noticed that. They're not uncommon in this part of the world. The spectrophotometer is securely mounted and suffered no damage, so I saw no reason to be alarmed."

"If you doubt that the hotel sank, just look into the hall," Jothen suggested. "There's an octopus with arms a foot long just outside of your door."

The doctor's only response was a look of scornful disbelief.

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Storm held out the plastic square containing the specimen, and said, "Several of these creatures got into the computers and caused short circuits. Then all the trouble happened. Do you know anything about it?"

"Certainly I do. It's a silverfish, *Lepisma saccharina*, one of the commonest species of *Thysanura*. I have two cultures of them here, as well as several other species. I am making a study of the blood proteins of the entire order."

Further questing revealed that three cultures of *saccharina* had been sent to Doctor Matouf by a North American collaborator "in Hunger Rock, or perhaps it was Starved Rock"; that during Doctor Matouf's recent absence the temporary custodian of the cultures had spilled the contents of a breeding jar; and that since then the doctor's room had been inhabited by an indefinite number of roving silverfish.

The insects were not exactly a surprise to Jothen, not after finding that Dr. Matouf was indeed still aboard the hotel — though never having seen a silverfish before, he had expected something decidedly more fish-like. Nevertheless, he was pleased to see them. Besides having shipwrecked the Barrier-hilthon, the minute, primitive creatures had given him an inspiration that he was beginning to think was almost diabolical.

On departing from Doctor Matouf's room they discovered that the octopus had shifted its position and was now directly in the doorway. Storm bent over, picked it up by the tip of one tentacle, regarded the writhing mass thoughtfully, and tossed it into the hall. Jothen glanced back at Doctor Matouf. He was sitting in a state of complete immobility, wide eyed, with his eyebrows at maximum elevation.

Storm and Jothen continued their tour of Sector Seven and discovered an emergency clinic established in a suite of connecting rooms. To Jothen's surprise it was staffed entirely by Tritons. It had not occurred to him that the Tritons would have their own physicians and surgeons. A steady stream of casualties flowed in for treatment. Another stream flowed out, to be transported to the Barrier-hilthon hospital in the upper levels.

"Does the hospital have room for all of them?" Jothen asked.

"No. It's overcrowded. The cases with minor injuries go out through the scapelocks like everyone else. Fortunately they're the majority. The cases who can't be put through a scapelock with safety are kept here. They'll have to wait until we have our lock-on two-way

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cargo airlock in operation. Then they can be put aboard a freighter."

"What about the dead?"

"The dead can wait. They're in the morgue under refrigeration."

Storm's office computer had recorded two more messages for him when he and Jothen returned to Level Ten. One message was an Evacuation Progress Report:

"One hundred five scapelocks in operation. Rate of transfer of evacuees, six hundred thirty per hour, fifteen thousand one hundred twenty per day. With maximum number of five hundred scapelocks rate will be sixty thousand per day. The lock-on cargo-lock will add an estimated three thousand per day."

Storm rubbed his chin thoughtfully. "Still not enough. At that rate it will take about four weeks to get everyone out. We'll need more lock-on cargo-locks."

The second message was from the sewage processing plant:

"How soon will movement of outbound cargo be feasible? We are storing compressed blocks of processed sewage solids in vacated rooms and halls immediately above us. Storage problem not yet critical but suggest early removal to mainland fertilizer plant for esthetic reasons."

"How did they dispose of the processed solids under normal conditions?" Jothen inquired.

"A special freighter came every day and removed the accumulation."

"Isn't there some provision for discharging sewage into the sea in an emergency?"

"No. The designers of the Barrier-hilthon didn't foresee this kind of an emergency any more than they foresaw that a day would come when the hotel would have to ration its food supply. And speaking of food, you must be famished. I'm keeping my promise that I would not be an ideal host. I can offer you two choices: Eat here in the hotel, in which case you'll receive a variety but in small quantity; or I can get someone to take you to our home where you may help yourself to our autoserver and have both plenty and diversity," Storm said.

"I'll wait a little longer and have the plenty and diversity," Jothen decided. Besides — he did not add — his own personal silverfish was ready to hatch now, and, as he well knew, the Barrier-Hilthon had already had its fill of those.

He made the short passage to Seahorse Reef on a hovercraft that was en route from the snorkel barges to Lizard Island. Darkness had fallen, the sky had

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cleared, and the brilliance of full moon flooded sky and sea. The outer Reef was a low, dark, irregular wall athwart their course. An endless succession of rollers marched out of the northeast, moonlight glistening on their rounded contours. The rollers struck the Reef at an oblique angle, creating a parade of ghostly white spume geysers that traveled along the Reef from north to south. Seaward, the flashes of rocket launchings on Osprey Reef, below the horizon, flared and died like heat lightning. Lizard Island, the Triton industrial center, lay westward ablaze with lights on the horizon of the lagoon behind the Barrier.

The hovercraft deposited Jothen on Seahorse Reef and churned away across the moonlight water, riding above a misty cloud of spray hurled into the air by the downblast of its rotors. The sound of its passage receded, became a pulsing hum, and ceased. Seahorse Reef was enveloped by a hushed, moonlit serenity — accented but not disturbed by the incessant march of spouting surf fountains that rushed along the coral ramparts of the Barrier with a rhythmic seething sound. Jothen felt that he had never seen such a luminous expanse of sea, such an immense arch of sky, such a host of brilliant stars, nor such a radiant moon.

He spotted Storm's home about one hundred yards distant on the inner shore of the islet. It would have seemed no more than a rounded hummock of coral if its artificial nature had not been indicated by a lighted oval window and — on its summit — a rotating beacon that flashed alternately green and white. Sea shells crunched under his feet as he walked toward it over the sparkling coral sand. He became aware of a murmur of voices and an occasional burst of laughter. He recognized Kim's voice.

He rounded a moss-covered corner of the house and discovered Kim and a Triton girl sitting on a small flat-topped peninsula of coral that extended into the lagoon like a jetty. A dolphin's head was bobbing up and down in the water, squeaking and chirping.

"Oh, there you are — finally! Jothen, this is Storm's daughter, Ruvani."

The dolphin whistled sharply.

"You forgot someone," Ruvani said, laughing. "Jothen, meet Molo."

"My pleasure," Jothen said. "But I've still got one more urgent piece of business first, if you'll excuse me. Kim, could I speak to you a moment?"

Kim allowed herself to be drawn aside readily enough, but her eyes were glinting. "What's

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this, Jo? Not another turn around the circular rainbow?" she asked laughing.

"No. I know where the pot of gold's hidden, now."

"Are you sure?"

"Well, I think I'll know in a minute. I've got two questions for you, and this time I'd like you not to answer the first until I've also asked you the second. Okay?"

"Well, I guess so," she said warily. "Go ahead."

"The first is: Will you marry me?"

Now she did look startled. "That's the *first* one? Hmm. Somehow I don't like that grin of yours, Jothen Kent. What's the second question?"

Jothen grinned more broadly than ever.

"The second is: *Who sank the Barrier-hilthon?*"

"I don't know," she said. "What do you mean, *who* sank it? I thought some sort of malfunction sank it. Do you mean it was a human failure?"

"Both," Jothen said. "The malfunction was caused by a certain kind of wildlife that had no business running free aboard the hotel. The custodian of the wildlife was one Doctor Kemal Matouf. And one guess who he got the critters from!"

Kim's face was a battleground over which amazement, consternation, anger and finally amusement pursued each other.

"Jothen Kent," she said, "this is blackmail."

"That," he agreed gravely, "is exactly what it is."

And so they lived happily ever after — but it wasn't easy.

—JAMES H. SCHMITZ AND NORMAN L. KNIGHT

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Galaxy Bookshelf

By Algis Budrys

Read any good books lately? By and large, the first objective of fiction is to establish contact between the writer and the widest possible audience. Whether he writes to get something out of his system, to communicate something, or simply because there is money in it, the writer hopes in his heart of hearts to strike a response from the whole world. In those terms, the three outstanding writers of our immediate time are Erle Stanley Gardner, Mickey Spillane and Ian Fleming. Probably the most successful writer the English language has ever known is Edgar Rice Burroughs. None of these gentlemen can write his way out of a paper bag, as writing is understood by three main types of literary specialists—teachers of composition, literary critics and the other working professional writers who provide the day-in, day-out reading matter for the fiction audience.

Now, whether the fault is with the understanding, or is in fact with the culprits named in the indictment, it still follows, on the basis of evidence observed over a long period of time, that any writer who attempts what is commonly called good prose, or who attempts a seriously intended comment on the human condition, or tries to plot and characterize with some attention to verisimilitude, is deliberately restricting his audience. This is self-destructive madness.

But madness is the common human condition and we have all learned to live with scores of diametrically opposed compulsions. the word is "compromise," or, if

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you don't care for those connotations, "balance" or "maturity." Somehow, most of us work it out; almost any day, one can meet working writers who are neither Gardner, Spillane, Fleming, Burroughs nor institutionalized.

Any sign of the commonly understood excellences in a piece of fiction therefore indicates one of two things. Most commonly, it indicates a craftsman consciously doing something difficult, for reasons which are not immediately explicable, are not simply logical and are the result of some often troublesome growth and change within an intelligent human being. More rarely, it indicates a man doing something he can't help, largely because it has never occurred to him to do anything that is not creative. In other words, an artist. A genius. The craftsman may produce a "better" variation on a given theme than the genius. Neither of them may produce anything anywhere near as "good" as the next genius, or craftsman. That is beside the point. The point is there are three kinds of writers; those who can't do much right except to overwhelmingly satisfy the audience, those who seriously study their trade and may very well have excellent technical justifications for what appear to be mistakes, and those who are a law unto themselves because they are extending the limits of the possible in literature. And since there are compromises in all personalities, almost all writers combine some of these aspects—they are only more or less craftsmen, geniuses and what psychological phenomenology calls *idiots savants*. Furthermore, no writer sells a product which can be definitely test-run against another similar product. He sells a service —a subjective experience—to each individual reader.

Problem: Where is there an objective basis for determining whether a piece of fiction is "bad" or "good"?

The Three Stigmata of Palmer Eldritch, by Philip K. Dick (Doubleday; $4.95) may or may not be a good book; it is an important, beautifully controlled, smoothly created book which will twist your mind if you give it the least chance to do so. Operating on a number of levels, the top one of which is a fast-moving narrative of business rivalry in a future Earth society, it proceeds to hand you a series of jolts straight to the dark corners of the mind.

Reality is, as you may know, a fragile thing; each of us has his own idea of the world and his place in it. From time to time, we get into some serious difficulty which brings home to us some drastic indication that the

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"world"—that great compromise out there beyond our skin—does not agree with our picture. At such times, we may even teeter on the brink of the awful suspicion that we have never known who or where we are, and that any previous ability to function was a lucky chain of coincidences which has now broken.

Science fiction and fantasy often play on this; a typical story aimed into this area is the one in which the hero gets a clue that all the other people in the world are robots, investigates, and then discovers that he himself is a robot. In life, some of the extreme reactions people display seem to stem from the next development of this personal setback; the suspicion that *nobody* knows where we're at. According to our bent, we may then decide that Charles Fort was "right," and quote from him to prove the point; we may decide that there really *is* a God, or that God is dead—the possible ramifications are endless, and have been worked out in great detail by such people as St. Augustine, Spinoza and Friedrich Nietzsche, who dealt with them as hard logical questions of considerable urgency. I have no idea, of course, how deeply Dick has delved into the works of those people; more deeply than I have, no doubt. But one place I'm sure Dick has done a lot of his preliminary work on this book is in the recent work with hallucinogens, a fascinating business which has been waiting for a top-grade science fiction writer to take it up.

Experiments with such substances as LSD, in which the subject is drugged into temporary dissociation from reality—that is, psychosis—normally are conducted in the presence of the experimenter, who also takes the drug and serves as the subject's "guide." He is able to communicate with the novice, is able to understand what he is undergoing, in a rough sort of way, and is to some extent capable of leading him through the labyrinth of what is, or should be according to conventional views, a totally personal and individual nightmare exploration of one unique subconscious.

This phenomenon of approximately shared hallucination —which, by the way, may very well be an artifact; a piece of preconditioning by an experimenter who is fudging Scientific Method —has led some people toward the possibility that there is what might be called a real unreality.

However all this may be in truth, it is a fact that many people who have been working with this general series of drugs are relaxed, pleasant, of the opinion that commonly accepted reality is a game, and that what

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they experience is not insanity but increased perception. The real reality is, for them, a place where time and perception are variable and arbitrary, but what is experienced is real, and marvelous. An important recent development in what could be called the "cult" of LSD is the promulgation of the ancient Tibetan Book of the Dead as *the* revealed, allegorical description of the real reality. That is, as a bible.

All this has had its share of publicity, particularly when Doctors Leary and Alpert were canned from Harvard and Aldous Huxley spent his last days proselytizing for it. Additionally, there are several informative books on the subject, of which the one I own is *LSD: The Consciousness-Expanding Drug*, a recent collection of papers and essays edited by David Solomon. But I'm not here to review science-fact books, immediate appearances to the contrary. If you remember, I started to review a witty, sometimes lighthearted, and always fascinating piece of fiction by a man who has already won one Hugo award for the best science-fiction novel of the year, and just may deserve another for this one.

To be glib, *The Three Stigmata of Palmer Eldritch* is something like an A.E. Van Vogt novel as Robert Heinlein and Frederik Pohl might have collaborated to write it. To be truthful, it is far more than a pastiche of anything else, because Dick seems to be something of a genius and is doing what that type of writer often does—borrowing techniques and tones from other men in order to say something entirely his own. There is also one wild scene which is a sudden infusion of pure Robert Sheckley, and I think obtrusively so, perhaps for the sheer fun of it. The remainder of the time, the whole creation resonates to the touch of the only present science-fiction writer who could possibly have done it.

The basic situation is that Earth is warming rapidly; the temperature in New York City is 180° Fahrenheit, and on the teeming urban Earth of that time —which is established as about one hundred years in the future, but functions exactly as our society would if it had slightly better technology—the only things anyone really cares about are coping with or ignoring the heat and the coming extinction of all life. The UN is concerned with doing something about it, the business community is dedicated to profiting from it, and the vast consuming public is alternately chivvied or lulled by these contending forces. The UN draft laws keep operating to pick up people and push them out into

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the various colonies like the ones on Mars, where they all live desultory lives on the UN dole. The big stabilizing factor in this comic inferno is two-fold—Perky Pat layouts and Can-D. Perky Pat layouts are miniature sets, in incredible detail, of the apartments, cars, analysts' offices, resorts and countrysides inhabited by two little dolls called Jerky Pat and her lover, Walt. All the colonists have them, and spend many skins—oh, I forgot; the economy is based on truffle skins, the only uncounterfeitable substance—on adding new pieces to them.

The layouts provide nearly perfect escape, for while they in themselves are only static sets, they become pocket universes when used in conjunction with Can-D, a hallucinogen. Under the influence of the drug, all the women playing with a given layout become Pat, and all the men become Walt. *The* Pat and *the* Walt. The confusions and orgies thus possible while sitting motionless in a friendly gathering are quite something.

Out of the fact that Can-D creates shared hallucinations has arisen a vague proto-religion, whose central tenet is that the Perky Pat world has some sort of validity. The colonists, who are far too busy with their layouts to do anything about their "real" environment, and who are in any case fed, clothed and sheltered by the UN, are grappling with the notion that they are all in fact only avatars of Pat and Walt.

However the Can-D/Pat logos, considered as the raw material for a religion, is subtly but crucially defective; the effect of Can-D wears off quickly, and in any case requires the layout; if the layout lacks as analyst's office, for example, there is no way Pat can get her head examined. To top it off, the UN permits the colonists to have layouts—though they are illegal on Earth — but prohibits Can-D, which must be obtained from pushers. So the use of this spiritual resource leads to accumulating guilt but no redemption.

Leo Bulero, the entrepreneur who both manufactures the layouts and heads the Can-D organization, knows full well how vulnerable his position is. He is galvanized into panic when rival entrepreneur Palmer Eldritch, who departed for Proxima Centauri many years ago and was thought lost, suddenly returns and markets Choo-Z, a new hallucinogen.

Choo-Z requires no layout and has UN sanction. Furthermore, its effect is apparently permanent, though it is a little hard to be sure of this. All the principal characters in this book are exposed to it at the crucial mo-

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ment when Bulero confronts Eldritch, or shortly thereafter. Part of the hallucinogenetic effect is a complete disorganization of the time sense; another is totally "real" detail. Yet another is the appearance of Palmer Eldritch in everyone's hallucinations, as the hero and, in effect, God of the hallucinated universe. Since Eldritch has long ago been given stainless steel teeth, an artificial arm and artificial eyes—the three stigmata—it is impossible to mistake him. But, though Bulero knows, through his precognitive Perky Pat fashion consultants, that he will kill Eldritch—or God—in the future, he is redeemed of guilt because another attribute of Choo-Z hallucinations is that everyone develops a steel arm, steel teeth, and artificial eyes, and it is as Palmer Eldritch that he goes out to do battle with Palmer Eldritch, except that for the final third of the book it is impossible for the reader to know whether this is really real or whether it is still part of Bulero's original hallucination, or whether the whole inferno is part of the hallucination Eldritch had when first exposed to Choo-Z on Proxima's planet, or whether the whole universe, including Eldritch, book, reader and this issue of *Galaxy* are part of Proximan hallucination, or what.

This is an approximate description of the story. If it is confusing, it is nowhere near as confused as the reader who tries to stay anchored to reality as such a thing is understood in the usual piece of fiction. Nor can it begin to convey all the detail or any of the side-tracks Dick drops into the story as casually as Heinlein handing you a complete picture of a civilization while telling you a story about two men out after the same thing. Unlike Heinlein's *Stranger in a Strange Land,* which had the different purpose of being *about* religion, *Stigmata* could easily function as a holy book in itself, since in Dick's logical system it is entirely possible for a $4.95 1965 commercial book to publish accurate, mystically revealed word of events which not only have not yet occurred but might not ever, but nevertheless prove the beliefs which are the only true Salvation.

Dick has really done it this time. Long recognized as the foremost elaborator of the involutional shock technique first introduced to science fiction by A.E. Van Vogt, he not only hits the reader with a new and disconcerting idea at measured intervals, he has created a plot which loop-the-loops back through itself so successfully that there is no real telling where it comes out. The last line of *World of Null-A,* you may remember, was "The

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face was his own." Dick had added "But who was he?" and he has put a capital H on "His."

Is it a good book? I couldn't tell you in a month of Sundays. Should you buy it? Hell, yes!

The Dark Side, edited by Damon Knight (Doubleday, $4.50) is a collection of twelve fantasy stories, mostly done in the modern, non-Gothic style whose most consistent appearance was in the early 1940's magazine *Unknown.* That journal, as some of you know, was for a long time after its demise known as "the late, lamented *Unknown*," by fond readers who found it considerably more to their liking than the involuted morbidity of the Victorian school which had given rise to such screamers as *Dracula* and, from another branch of the same night-blossoming cereus, *Frankenstein. Unknown* itself was the stablemate of *Astounding,* and partook of the sometimes-cheeky, always no-nonsense engineering view of its story problems. Vampires were dealt with in terms of their function, not their subconscious symbolic implications; if a human victim happened to be unavailable, a quick raid on the local hospital's blood bank would do just as well, and even the vampires agreed it was much neater. There's a lot to be said for it as a source of entertainment, and not for a moment should you believe that all of it left you laughing. Those of you who have not had much truck with fantasy will find some stories here that are so good they couldn't possibly be that stuff you don't like. Those of you who have been hoping for just one more issue of *Unknown* have now found a close approximation of it, with some skillful editorial handling and footnoting by Knight, a story of whose own would not have been omitted by any other editor.

Three of the stories *are* from *Unknown*: "They," by Robert Heinlein; "Trouble With Water," by H.L. Gold, and "It," by Theodore Sturgeon. "Trouble With Water" is very funny; "They" and "It" are not. "They" attacks the same place Philip K. Dick was getting at in *The Three Stigmata of Palmer Eldritch,* and "It" is a moody, horripilating and masterfully told story about a thing that just came to life in the woods one day. There is a Ray Bradbury story, "The Black Ferris," a fantasy built around the use of a carnival ferris wheel as a sort of time machine; there is Anthony Boucher's very short, very snappy story which I think is the last word in how to come out winners if you make a deal with a demon, "Nellthu." Among favorites are "Casey Agonistes"

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by Richard McKenna, who could tell a masculine and yet tender story as well as anyone I've ever read, and T.L. Sherred's "Eye For Iniquity," which is about a man who could literally make money by just thinking about it. That latter story, by the way, is from *Beyond, Galaxy's* late, lamented stablemate of the early 1950's. There is not a disappointing story in this book; there are few which anyone who likes modern science fiction would not enjoy just as well and, in some moods, better. I wish someone would do something about that.

The Eighth Galaxy Reader, Edited and with an introduction by Frederik Pohl (Doubleday, $3.95), is a collection of twelve stories from this magazine, their copyright dates ranging up from 1961.

In the order of their appearance in the book they are "Comic Inferno" by Brian Aldiss; "The Big Engine," by Fritz Leiber; "A Day on Death Highway" by Chandler Elliott; "The End of The Race" by Albert Bermel; "The Lonely Man" by Theodore Thomas; "A Bad Day for Vermin" by Keith Laumer; "Dawningsburgh" by Wallace West; "And All the Earth a Grave" by C.C. MacApp; "Hot Planet" by Hal Clement; "Final Encounter" by Harry Harrison; "If There Were No Benny Cemoli" by Philip K. Dick and "Critical Mass" by Frederik Pohl and C. M. Kornbluth.

Among them you will find science fiction writing of nearly every kind, ranging from the Aldiss, which is heavily influenced by the Kingsley Amis critical construct of the same name, through such plain statements of picque with our society as the Elliott, the Bermel, the Laumer, and the MacApp, and on to "straight" sf like "Hot Planet." Fritz Leiber's story is a fine mood-builder about the wheels that really make the world go 'round. "The Lonely Man" is a very well done character study of an engineering genius; Thomas has authored quite an accumulation of quietly good stories with staying power—I've re-read this one several times with considerable pleasure. Philip K. Dick's story is, as usual, markedly individual, and distinguished for his ability to draw fine-line social caricatures paradoxically freighted with verisimilitude; ditto the Pohl & Kornbluth story. I would say the book as whole reflects a sense which is best summed-up in Harry Harrison's story about an exploration team searching, against the weight of accumulating loneliness, for other races in this galaxy. They find one, at last, and deal with it in-

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telligently, but not without some confusion and apprehension. Nor are the members of the team themselves quite human as we understand the term at this young point in our development. And the aliens, it turns out at the story's climax, are not truly alien, but are other men, evolved from ourselves, who long ago set out exploring and became separated from the branches of humanity represented by the team. If there is disappointment in this isolated thing, there is much to be proud of in many others, and there is the mutual purpose of, now, going exploring together in the other galaxies that lie beyond our own.

There is this sense in this book, as I said, that modern science fiction reflects a dissatisfaction with things as they are, sometimes to the verge of indignation, but also retains optimism about the eventual outcome. There is something rather deeper than the recurrent strain in the "Golden Age" science fiction of the 1940's —the implication that sheer technological accomplishment would solve all the problems, hooray, and that all the problems were what they seemed to be on the surface. There is no overall easy answer among the stories in this book, and not many of them attempt to deal with problems larger than those in the immediate story situation, but collected in this way they show writers and writing which have gotten markedly farther up the road toward tackling hard questions in honest ways. Sometimes it's not done more than adequate. Sometimes it's done tongue-in-cheek, sometimes it's done heart-on-sleeve. But it's done, and it's encouraging to see, and I expect most of you will agree it's worth reading.

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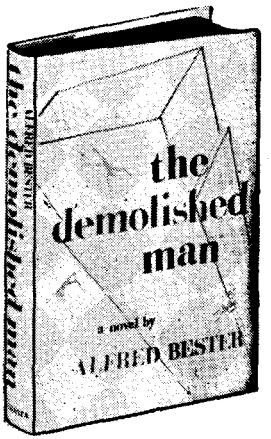

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